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IMPACT OF CHANGE TO A PAY THE PRODUCER METHOD OF PAYMENT ON ALBERTA'S GRAIN AND LIVESTOCK SECTORS

CANADIANA

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IMPACT OF CHANGE TO A PAY THE PRODUCER METHOD OF PAYMENT ON ALBERTA'S GRAIN AND LIVESTOCK SECTORS

Prepared by:

Alberta Agriculture in Consultation with the Alberta Wheat Pool

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ACKNOWLEDGEMENTS

The Impact Study Group would like to thank the Steering Committee for their guidance, understanding and support throughout the study. The goal to determine impacts in each of the seven regions of the province was ambitious. The Study Group, while appreciating the desire of all farmers to be able to understand the changes which may be expected to occur in the area in which they live and farm, made every effort to fulfill this goal. In coordinating this very challenging task I wish to thank all those who contributed to the successful completion of this study. To Diane Dunlop, Larry Ruud and Wayne Lohr, the researchers on the project, a special thanks for their unselfish dedication to the project. The Alberta Wheat Pool staff members' input is recognized. To Nancy McLaughlin and Joyce Cameron who kept us on track sending faxes and typing and typing and typing -- What would we do without you?

To the "Crow" -- you are a topic like none other.

F.X. Kehoe
Member
Planning Secretariat

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EXECUTIVE SUMMARY

Background

At present, the Crow Benefit is paid directly to the railways for the transportation of grains destined for export. This method of payment has been recognized as having an effect on the price of grain for the local livestock and processing industries. The price at which feedgrains are sold to local consumers is inflated due to the current method of payment. The current Alberta/B.C. initiative proposes a change to a "Producer Method of Payment."

Objective

A committee of personnel from Alberta Agriculture, B.C. Ministry of Agriculture and Fisheries, and Alberta Wheat Pool formed a Study Group with the objective of determining what effect a change in the method of payment would have on Alberta's and B.C.'s grain, livestock and related industries. The specific tasks undertaken were the quantitative assessment:

1. of impacts at both the regional and farm level with respect to crops and livestock;
2. of the impact on the crop and livestock sectors in other regions of Canada; and
3. on grain and livestock trade between Alberta and B.C. and the United States.

Method of Analysis

Previous studies, on the effect of a change in the method of payment, have tended to focus on predicting prices, production and marketing changes into the future. These approaches, however, raise the problem of the uncertainty of general economic conditions and the international market in the future, as well as the agroclimatic factors, such as rainfall, crop rotations, resource restrictions, and biological constraints which can all play a role in farmer and rancher decisions.

To avoid such problems, the study group adopted a historical approach using data and applying the analysis to the period 1978 to 1988. This enabled the analysis to be conducted over a period where the factors affecting farming decisions were known with certainty. A simulation model, based on actual data calculated prices, production and trade levels, while allowing for crop otational and livestock biological constraints was utilized in this study.

Having determined a baseline using actual data the model was then 'shocked' by means of reducing the Canadian Wheat Board net initial payment for grains and the market (farm gate) price for canola to reflect the fact that a farmer would have paid a higher freight rate had the method of payment been changed over the time period. The model therefore provides for an estimate of the agricultural impacts of a decrease in the market returns for grain and canola over a past 10 year period.

The analysis was carried out for each of the seven Agricultural Reporting Areas (regions) in Alberta. A map of the regions is provided at the end of the summary. The purpose of such a detailed analysis was to study the effect of a change in the method of payment in regions of the province which have similar crop rotations and livestock activities. This provided the opportunity to analyze the effects a decrease in the price of grain caused by change in the method of payment would have on a region, taking into account specific factors which might have influenced that region.

The crops analyzed in this study were wheat, barley and canola. Estimated changes in oat production in the Red Deer region, a large oat growing area, was also examined. Specialty crops were not examined. The livestock sector was studied in terms of changes in off-Board barley prices, calf and feeder prices, heifer replacements, beef cow numbers, feeder cattle inventories, and hog breeding stock numbers. Changes in Alberta's feeder exports to Ontario, feeder imports from Saskatchewan, slaughter cattle exports to the United States and the carcass weight of cattle slaughtered in Alberta were also analyzed.

Upon determining changes in net initial payments and local market prices, crop production, livestock inventories and regional trade patterns, benefits to Alberta farmers and ranchers in terms of changes in gross revenue was then calculated. This study assumes grain producers will be fully compensated for the increase in transport costs as the Crow Benefit payment is diverted from the railway to the producer. Any dilution of Alberta's share of the Crow Benefit on a per tonne basis, due to payments

being made on sales to the domestic market, was assumed to be covered by the Alberta government.

A farm level analysis on representative farms around the province of Alberta was conducted to provide a further assessment of the response to the proposed change in method of payment. This analysis was compiled as a separate report from this study. It focuses on regional and provincial on-farm effects. The farm level study utilized a linear programming model, optimizing producer gross margins. The results of the analysis, in terms of direction of change in producer returns, correspond with those found in this study.

The foregoing has centered on the method of analysis for Alberta's agriculture. Lack of data on B.C.'s grain and livestock sectors, as well as time limitations have, to the present, prevented an assessment of the effects of a change in method of payment on B.C.'s agriculture being included in this report. A farm level analysis on grain, cow/calf, feedlot, and mixed grain and livestock farms is being conducted to provide an estimate of the effects on B.C. agriculture.

Results

The figures presented here represent the cumulative impact over the period 1978 to 1988. It was estimated that production in all regions of the province would have changed in response to a decrease in the market

returns for grain caused by a change in the method of payment. There was considerable variation in response from region to region and between grains.

Wheat in regions 1, 2 and 3 showed a total increase over the whole period, although accuracy of the estimated response in region 1 was less than desired and must be treated with caution. In regions 4, 5, 6 and 7 there was a decrease in the production of wheat over the period which more than offset the increases, so that for the province as a whole there was a 4% (200,000T) decrease in annual wheat production. A very large percentage decrease in wheat production in region 5 (42%) should be viewed with caution.

Barley production increased in regions 1 and 3 but decreased in all other regions. The changes in production of barley in region 3 were mixed and extreme and it is unlikely such changes would have occurred. In all other regions changes were moderate. In aggregate for the province barley production increased by 2% (130,000T) as a result of a change in the method of payment.

Canola production showed an increase in all regions except region 5 where it was not possible to estimate the change, and region 6 where the response was mixed and there was a decrease in some years. The greatest percentage increases were shown in regions 3 and 7 where increases of 25% and 34% were estimated. It was felt that crop rotation requirements might have limited the magnitude of the response. Overall for the province it was

estimated that canola production would have increased by 17.5% (250,000T). If the farmers in regions 3 and 7 did not respond as much as estimated, the 17.5% increase would be reduced but the results would still indicate there would have been a substantial increase in canola production for the province as a whole.

For the Province of Alberta, wheat production would be expected to have declined by approximately 4% (200,000 T) following the change to a producer method of payment. Barley and canola production were found to increase by 2% (130,000T) and 17.5% (250,000T), respectively. Comparing production patterns across the province, it was apparent that wheat and barley production are expected to increase in southern Alberta but decrease in central and northern regions. The pattern likely reflects the lack of alternative dryland crops in southern Alberta plus the concentration of irrigation in the southern regions. The study indicates a decline in wheat and barley production in central and northern Alberta. In central and northern Alberta, farmers have the opportunity to produce all of the crops analyzed plus forage. The study estimated that canola production would increase in all regions. Canola production is also expected to increase in southern Alberta, quite likely on irrigated land. An increase in oat production in the Red Deer region, west-central Alberta, would have been expected although the response was mixed.

The Canadian Wheat Board net initial payment sets a floor in the domestic feed barley (off-Board) market price. As producers pay the full costs of shipping grain by rail the net initial payment will decrease and in turn

the local off-Board barley price will decline. Following a decline in the off-Board barley price, the analysis suggests that calf prices will rise approximately $4 per 100 pounds.

The increase in calf prices is expected to have a positive impact on the profitability of cow-calf enterprises. In response to this improved profitability, cow numbers are expected to increase.

Provincially, Alberta's cow herd is expected to increase by 12% (125,000 head). All regions in the study exhibit an increase in cow numbers. This increase in cow numbers and calves in conjunction with lower feedgrain prices, would in turn have influenced feeder cattle numbers.

Feeder cattle inventories will increase an estimated 185,500 (23%) in Alberta from the current situation. Under the situation without ACBOP, the analysis indicates an increase of 219,000 head over the 1980 to 1988 time period. All regions exhibit an increase. The study also indicated that while the increase in feeder prices would give an advantage to a farmer feeding calves to slaughter weight. The effect on farmers feeding heavy weight feeders would likely be less than on those feeding calves as the feeders are bid up in response to the lower feed grain prices. Feeder imports from Saskatchewan are expected to increase approximately 14,800 head (9%). No pattern was identified for feeder exports to Ontario over the time period 1978 to 1988.

The analysis of hog breeding stock inventories suggests that prior to 1985 hog numbers would increase 5 - 10% (4,000 to 6,000 head). After 1985, the analysis indicates little change.

The study also examined the change in livestock numbers from a scenario where no Alberta Crow Benefit Offset Program was in place, to a change in method of payment. In 1985 when the Crow Benefit Offset program was introduced, the barley price distortion is estimated to have been $23.79 and payments were $21.00/tonne. In 1986 and 1987 Alberta Crow Benefit Offset Program payments remained at $21.00/tonne, in late 1987 the payment was reduced to $13.00/tonne. The barley price distortion in 1986, 1987, and 1988 is estimated to have been $8.72, $10.32 and $13.00 per tonne, respectively.

Changes shown to occur after a change in method of payment and a decrease in the grain price, were therefore, less than would have occurred had Alberta Crow Benefit Offset Program not been in place. As a result, a change in the method of payment from a scenario without Alberta Crow Benefit Offset Program over the 1985 to 1988 period resulted in an estimated 307,400 head (45%) per year increase in feeder inventories. This is compared to the 230,300 head increase from the current situation with the Alberta Crow Benefit Offset Program over the 1985 to 1988 period. Therefore, the Alberta Crow Benefit Offset Program has resulted in an average annual 77,000 head increase in Alberta's July 1st feeder cattle inventory over the 1985 to 1988 period. Cow herd and hog numbers did not differ under this scenario compared to the change in method of payment

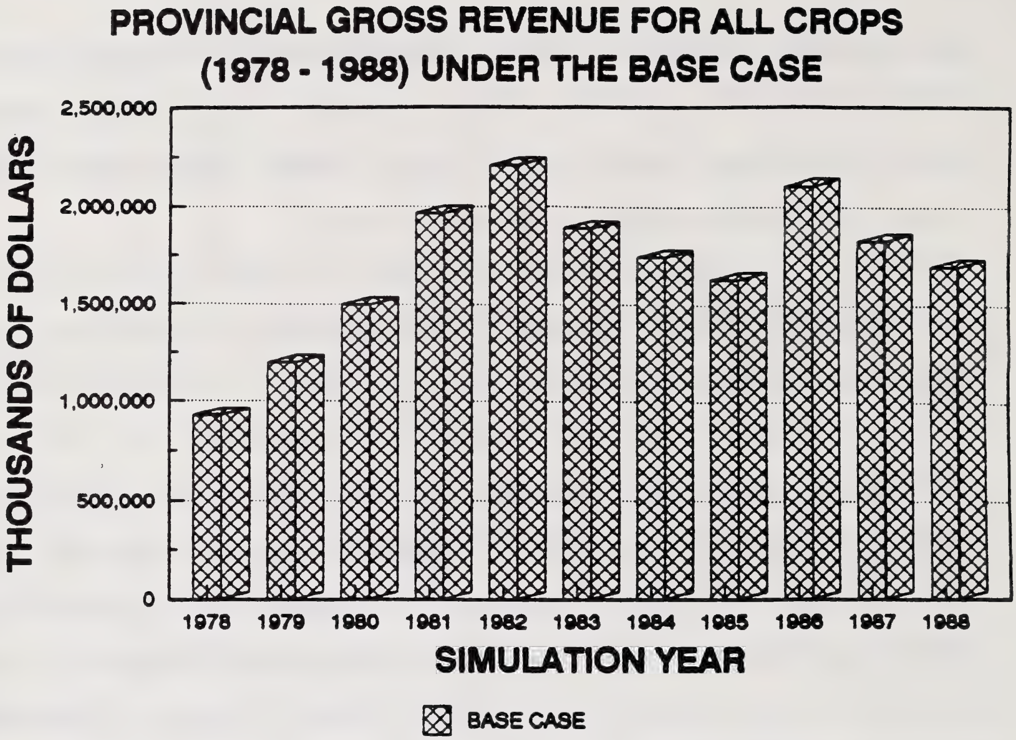
from the current situation. This is likely due to the relatively short time period in which the offset program has been in place. Feeder cattle imports and slaughter cattle exports were, however, significantly lower without the Alberta Crow Benefit Offset Program.

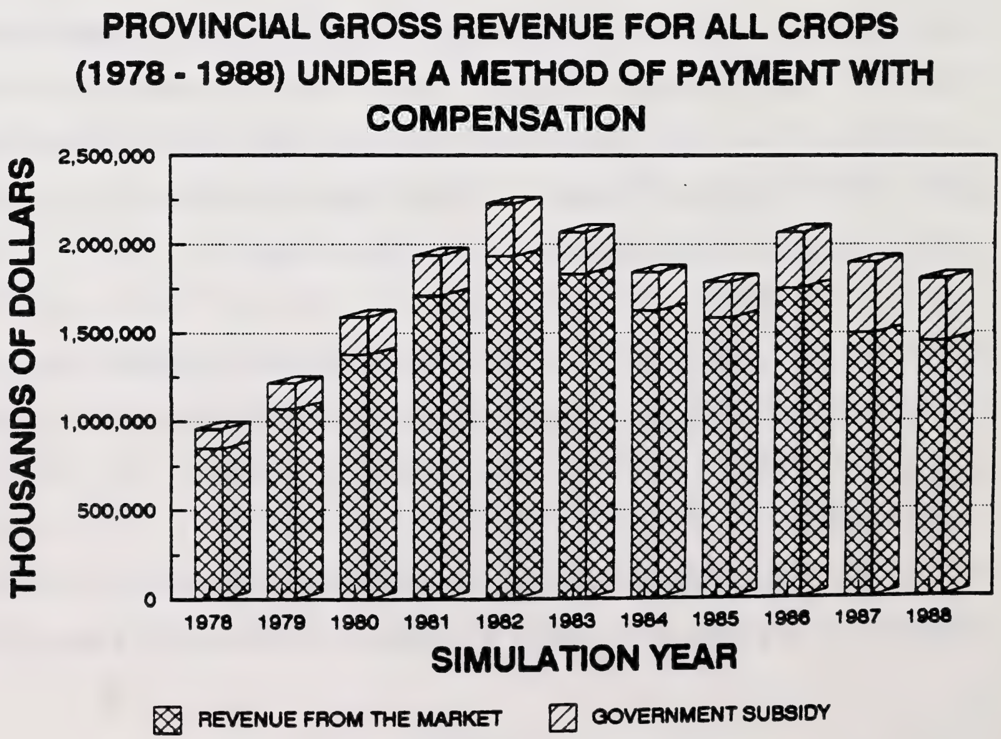
Feeder exports to Ontario appeared to be influenced by factors other than the Alberta Crow Benefit Offset Program.

The following graphs depict changes in gross revenue to grain farmers comparing the baseline to a producer method of payment. When the Crow Benefit payment is included, the gross revenue of grain producers in all regions, except 5 (Red Deer) and 6 (Barrhead), increases. The increase in gross revenue varies from $2 million in Region 1 (Medicine Hat) to $38 million in Region 3 (Calgary). The increase in Region 3 is largely due to the exceptionally large increase in barley production so should be viewed cautiously. Regions 5 and 6 experience decreases of $16 million and $9 million, respectively. For the province of Alberta as a whole, the average annual increase over the years studied was $54 million, an increase of 3% in the gross revenue of grain farmers.

As well as the increase in the gross revenue of grain producers, the cost of feed grains to livestock producers was estimated to decrease by $28 million.

The results of this study indicate part of the cost savings to livestock feeders will be passed on to cow-calf producers in the form of higher calf


PROVINCIAL GROSS REVENUE FOR ALL CROPS
(1978 - 1988) UNDER THE BASE CASE
THOUSANDS OF DOLLARS
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
SIMULATION YEAR
BASE CASE


PROVINCIAL GROSS REVENUE FOR ALL CROPS
(1978 - 1988) UNDER A METHOD OF PAYMENT WITH COMPENSATION
THOUSANDS OF DOLLARS
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
SIMULATION YEAR
REVENUE FROM THE MARKET
GOVERNMENT SUBSIDY

prices. As a result of higher calf prices and increased cow numbers, the annual gross revenue of cow-calf producers is expected to increase $88 million (14%) with a producer method of payment. The increases are small in the earlier years as heifers are retained and farmers begin to expand the cow herd. The increase in annual gross revenue over the last five years (1984-1988) of the simulation period is generally over $100 million.

This study also indicates the economic activity in the feedlot sector would change (see attached graph). This sector on average for the years studied could anticipate an increase in gross revenue of $330 million (28%) from a change in the method of payment; $88 million of this increase in revenue would accrue to the cow calf segment of the industry. Regions 2 (Lethbridge), 3 (Calgary), 4 (Vermilion) and 5 (Red Deer) experience the largest increases. These regions are the main feeding regions, with over 85% of all feeding occurring in these regions. Regions 1 (Medicine Hat), 6 (Barrhead) and 7 (Peace River) exhibit small increases in feeder activity and gross revenue.

The analyses of the impacts of a producer method of payment indicates an increase in gross revenue to both the grains and livestock sectors. The losses in Regions 5 and 6 in grain revenues may be the result of producers growing crops other than those analyzed and forages, as well as increasing livestock numbers. The analysis indicates an increase in the annual gross revenue of the livestock sector in Regions 5 and 6 of $65 million and $10 million, respectively. As such, the overall benefit, in terms of gross revenue, to Regions 5 and 6 was $49 million and $1 million,

depending on which livestock enterprise they have in their operation. The benefits to livestock farmers stem from the decrease in the price of feedgrains.

The results of this study indicate a change to a producer method of payment of the Crow Benefit would encourage additional livestock production and enhance the gross revenue of Alberta's grain and livestock farmers. The magnitude of this response did, however, vary among the regions.

Following a review of the results derived from the analysis, Alberta Wheat Pool staff members in the Study Group withdrew active participation in the development of the Impact Study report. Drafts of the report were reviewed by all parties on the Steering Committee and their responses and concerns were incorporated into the final draft. However, in responding to the final draft, Alberta Wheat Pool staff members expressed the following caution: "The implication of this is that while the study can provide us with a rough idea of the direction and the magnitude of changes occurring because of a MOP change, the estimates should not be viewed as hard and fast numbers. AWP members of the committee felt this point was not adequately discussed in the study." For the detailed critique by Alberta Wheat Pool staff members and Alberta Agriculture's response, see pages xv - xxiii.

ALBERTA WHEAT POOL COMMENTS ON THE STUDY

AWP members of the Impact Study group note that because of a number of unresolved problems with the Impact study they are unable to accept or endorse the findings presented in this report.

It is considered that a number of technical concerns with the model limit the reliability of the results and that this is not properly addressed in the report. Further, the report is misleading because it overstates the benefits of a MOP change, does not make clear what level of compensation is required to put grain producers in a situation equivalent to the current MOP, does not make a clear comparison with the Alberta Crow Benefit Offset Program and provides results based on a number of unrealistic assumptions. A summary of concerns is given below:

1. The basic hypothesis of the study is that a change in the method of payment of the crow benefit, through it's effect on the price of grain, will cause farmers to change their crop and livestock production patterns. The important assumption here is that price is a significant factor in terms of production. However, in a number of the grain supply equations the price of the grain is not included as a variable. AWP members of the committee feel that the study should accurately reflect how farmers make decisions and that to exclude price creates a bias in the equations and produces unreliable results.

2. The inclusion of a variable representing the government share of transportation costs (the GTRAN variable), caused much discussion within the committee (refer to pages 28 to 32) and AWP members felt the problems that exist with the use of this variable have implications for the results.

   The authors suggest that GTRAN may be a trend variable (page 31) but that since the model is driven through price, it has no apparent consequence. If this is the case, then the equations should be reestimated with a true trend variable which would change the existing coefficiencies and alter the impacts of the MOP change. This is particularly important because of the heavy emphasis on only a few variables. A correct trend variable needs to be used if the results are to be reliable.

3. Econometric models are always subject to limitations imposed by the availability of the data. This model is no exception. Only ten years of data existed for analysis and it is important to point out to the reader what this implies for the results. The model provides estimates which are averages within a range; because of data limitations the ranges in the grain supply equations are very large and may cover negative values to positive values.

   The implication of this is that while the study can provide us with a rough idea of the direction and the magnitude of changes occurring because of a MOP change, the estimates should not be viewed as hard

and fast numbers. AWP members of the committee felt this point was not adequately discussed in the study.

4. It is important in the analysis of results to keep in mind whether in a practical sense the results can be considered reasonable. For example, increases in barley production as high as 1 million tonnes were estimated for region 3 but the authors go on to say that such increases probably could not occur because of restrictions in available fallow acres. Later in the report (page 100), they also note that if the response in region 3 is less than estimated that the response for the province could be "no change or a slight decrease". Such limitations need to be reflected in the estimation of gross revenue changes.

   Again, the model also estimates that the strong demand for calves would increase imports of feeders from 90,100 to 350,170 head increasing gross revenue to cow-calf producers outside of Alberta by $143 million (based on the data in the report). AWP members of the committee question whether it can be considered realistic to assume that calves will continue to be supplied to Alberta's feedlot sector in these numbers without a reaction from areas supplying the calves to Alberta.

   The AWP members of the committee felt the results were interpreted in a way which overstates the impacts.

5. The impact study was undertaken to answer the basic question of what would be the effect on agriculture of a change in the MOP? The results of the model should be used to tell us how much would grain producers need to be compensated to put them in a situation equivalent to where they were before the MOP change and what are the effects on the livestock sector over and above those already achieved through the Alberta Crow Benefit Offset Program? (ACBOP).

The model is developed on the assumption that grain producers will be fully compensated for the increase in rail freight rates as the crow benefit is diverted from the railway to the producer, i.e. that dilution will be paid by the Alberta Government. The cost of dilution has been estimated as approximately $105 million in 1988. This study shows that when this increased level of subsidy is paid to grain producers, gross revenue to the producers increases by $54 million.

The model has determined the average decrease in the off-board barley price to be $12.47 per tonne. The 1988/89 Alberta Crow Benefit Offset program subsidy to the livestock sector was set at $13/tonne. Given that the distortion in the domestic barley price had been corrected, it is not clear to AWP members of the committee how a MOP change could have achieved a greater impact in the livestock sector than could be achieved through the ACBOP program.

AWP members of the Committee feel the report does not properly answer two of the basic questions the study was designed to address.

6. It is noted in the report that there will be an average annual increase in gross revenue in the feedlot sector of $330 million (page 156) as the slaughter output increases from 1.149 million animals to 1.479 million animals. Barley price is estimated to fall an average of $12.47 per tonne and the calf price to increase by $24.15 per animal. With a feed regime of 1.6 tonnes barley per calf, there would be a net disbenefit to the feedlot of $4.20 per animal.

   AWP members of the committee consider that to assume feedlot operators would expand production to the extent reported in the study when they have a decreased margin is unrealistic. It would seem more appropriate to assume that, consistent with the current market, calf prices would only be bid up to a level which allows the feedlot enterprise to maintain margin at a new equilibrium level. The number of feeder cattle would therefore only increase to a level which maintained present margins for feedlot operations.

   AWP members of the committee feel that unrealistic assumptions have been used in the estimation of some figures and that this overstates the impacts of a MOP change.

ALBERTA AGRICULTURE RESPONSES TO ALBERTA WHEAT POOL COMMENTS

1. Crop Production Response

Each grain supply equation was tested and proved to be an accurate predictor of the actual price and production behaviour of farmers in the respective regions. These supply and price equations were developed in consultation with farmers, industry and crop specialists. The methodology and functions used for each predictive equation, as well as graphs displaying the accuracy of the equation are presented in Appendices B and C of the report.

2. The Crow Benefit

GTRAN is the historical value of the Crow Benefit. The price of grain both at the elevator and in the local off-Board markets include the Crow Benefit. As the price of grain is a very important determinant in crop production and the Crow Benefit is part of this price, the Crow Benefit will be included in many production estimates.

3. Estimates

The limitations associated with ten years of data are clearly described on page 5 of the report. This limitation is acknowledged in the estimates of change reported in the study for the historic period 1978-1988. In spite of this limitation Alberta Agriculture feels confident that the results reported in the study accurately reflect the direction and magnitude of change which would result from a change to a producer payment.

The Alberta Wheat Pool staff members note in their comments that "The implication of this is that while the study can provide us with a rough idea of the direction and the magnitude of changes occurring because of a MOP change, the estimates should not be viewed as hard and fast numbers."[1] The reason the report contains a single aggregate estimate of benefits is that the estimate ranges which could apply for each commodity, in each region, in each year are not cumulative, e.g., a barley price at the low end of the range would generate a livestock response at the high end of the range. Thus, it is misleading and would be methodologically wrong to aggregate all low ranges and all high ranges to arrive at a composite range. Throughout the report the results are represented as estimates.

4. <u>Cow Herd and Feeder Cattle</u>

With regard to the acquisition of feeder cattle, both from within Alberta or outside the province, the model results reflect increases in calf prices in Alberta. Alberta calf prices are not independent of calf prices in other regions. It is reasonable to assume that calf prices, and in turn, cow herds in adjacent regions would respond in a manner similar to the response estimated for Alberta. A recent study by the Saskatchewan Wheat Pool estimated cow numbers in Saskatchewan could increase by 200,000 head in response to a change to a producer payment of the Crow Benefit.

5. <u>Alberta Crow Benefit Offset Program and Dilution Payments</u>

The study reports on the impact the ACBOP program has had in the relatively short time (four years) it has been in effect.

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1. Alberta Wheat Pool Comments on the study.

Given that the cattle cycle is estimated at ten years, the industry's response to ACBOP is far from complete. The objective given the Impact Study Group by the joint Alberta Wheat Pool, British Columbia Ministry of Agriculture and Fisheries and the Alberta Government Steering Committee was to analyze the effect of ACBOP to date. The report includes this analysis. The Alberta Crow Benefit Offset Program treats only the symptoms of the current Method of Payment. A change in the method of payment to a producer payment will cure the problem it will remove the distortion from the market price.

The Steering Committee set forth a guideline that grain farmers were not to have their income reduced through dilution of the Crow Benefit. The Alberta Wheat Pool members of the Study Group suggest that farmers only be compensated to a level where they were prior to a change in the Method of Payment. Their text reads: "The results of the model should be used to tell us how much would grain producers need to be compensated to put them in a situation equivalent to where they were before the MOP change and what are the effects on the livestock sector over and above those already achieved through the Alberta Crow Benefit Offset Program."

The guidelines set forth by the Steering Committee ensure that grain farmers retain their Crow Benefit and in no way precludes them from realizing a net gain ($54 million).

6. Effect on the Cattle Feeders

Given the dynamics of the livestock industry, removal of the distortion in domestic feed prices would be totally or partially bid into the price of calves. Contrary to the Alberta Wheat Pool staff report of a price increase of $24.15 per calf, the results of the study indicate that the price of a 525 lb. calf would have increased $20.21 per head in a scenario of changing to a producer payment from one of no ACBOP. With a feeding regime of 1.6 tonnes of barley per calf fed to slaughter weight, the feed cost savings would be $20.80 per head. This is break even margin, typical of a competitive industry.

The report which follows is an accurate and fair representation of the findings of the study on the impact of a change to a producer method of payment.

I. INTRODUCTION

Background

It is anticipated that a change in the method of payment of the Crow Benefit to a direct farmer payment will impact farmers and processors throughout Alberta. The current method of payment offers a direct benefit to the grain farmer selling grain through the elevator/rail system, but it is recognized that this method of payment has an effect on Alberta's pricing of grain for the livestock and processing industries.[1]

The grain exporter currently receives the full Crow Benefit in the form of a payment to the railways on the farmers behalf. With a change in the method of payment the farmer will be receiving the Crow Benefit in a direct manner, and in turn the farmer will pay a much higher freight rate. On the sale of Canadian Wheat Board grains this higher freight rate paid by the farmer will result in a lower initial payment for grains delivered to the elevator. On the sale of off-Board grains the price at the elevator is also expected to reduce through an increase in the 'basis". In both instances the grain farmer will be paid less for grains delivered to the elevator. The grain farmer will, after completion of the sale, receive his Crow Benefit directly from the government.

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[1] Trade implications of a pay the producer method of payment are located in the Appendix.

Method of Payment

The method of payment analysed in this analysis include the current payment to the railway and a payment of equivalent funds to the grain producer in Alberta. The payment method is derived from that recommended by the Committee of Inquiry into the method of payment chaired by Judge G. Hall, 1985, and expanded to include payments on home grown grain fed on the farm. Under the analysis grain producers were assumed to receive the equivalent of the payments formerly made to the railway on a net of marketings plus farm fed quantities. Feed grains purchased would be subtracted from the total marketings plus farm fed and a farmer's eligibility thus determined.

The influence of a change in the method of payment on the livestock feeding industry will be dependent upon the degree to which the price of feedgrains for local sales drop in response to the lower price at the elevator.

Objectives

A committee of personnel from Alberta Agriculture, B.C. Ministry of Agriculture and Fisheries, and Alberta Wheat Pool was formed with the objective of determining what effect a change in the method of payment would have on Alberta's and B.C.'s grain, livestock and related industries. The specific tasks undertaken were the quantitative assessment:

1. of impacts at both the regional and farm level with respect to crops and livestock;
2. of the impact on the crop and livestock sectors in other regions of Canada; and
3. on grain and livestock trade between Alberta and B.C. and the United States.

The objective of conducting an impact analysis is to determine, accurately and objectively what effect a change in the method of payment (MOP) will have on Alberta's grain, livestock and related industries. In an effort to offer farmers a high level of understanding regarding the impact, this analysis will be conducted on a regional, Agriculture Reporting Area basis where possible. In an effort to supplement the general economic estimates derived from the econometric analysis, an analysis will be conducted to determine the impact a change in the MOP will have on a "typical farm" in the various regions. The impact of the change will be estimated for crop, livestock and mixed farmers in a manner such that farmers can interpret the results and with confidence make a decision regarding the MOP.

Method of Analysis

To achieve these objectives two approaches were employed. First, the application of an econometric model to determine the changes which could be anticipated in crop and livestock production and returns on a regional basis. Second, an analysis of changes which could be anticipated in the operation of typical farms in each region. This approach was considered by the impact committee as the most reliable approach available.

An econometric model is only as good as the assumptions that underly it, both in the individual equations and in the structure and relationships of the model itself. Econometric analysis can only be used to make inferences about a postulated hypothesis. It can not be used to prove a theory but only to lend credence to an economic hypothesis about behaviour. All attempts have been made in this model to make realistic assumptions about the nature of grain and livestock production in Alberta.

The hypothesis accepted for the study was that, with a change in the method of payment, farmers will change their crop and livestock production patterns and will face changes in their revenue and welfare. The econometric analysis and the typical farm analysis were designed in a manner which would identify changes in production, revenue and welfare, if any were to occur in response to a change in the MOP. In order to identify these changes the econometric model was developed and applied to the situation which occurred over the years from 1978 to 1988. The model was developed to represent these eleven years and the analysis was conducted over these same years. This approach was developed and accepted by the University of Alberta in a recent Master of Science thesis by D. Dunlop. The advantage of this approach is that the analysis is conducted over a time period where exogenous variables such as interest rates and exchange rates are known.

In order to achieve the objectives of the paper, an econometric model was estimated to explain the production of grain and livestock in Alberta. This model was then used to simulate a market price adjustment in grains

arising from a method of payment change. A farm level linear program to estimate individual production adjustments was also estimated and is covered in another report.

The model consists of seven regions divided according to geographical and production characteristics. For each region behavioural equations for grain and livestock production were estimated for the years 1978 to 1988. Reliable regional data for the period before 1978 does not exist. While there are some limitations in basing an analysis on only a few degrees of freedom, this regional approach was agreed upon by both Alberta Wheat Pool and the Alberta Government. It was felt that it was necessary to have a detailed regional analysis and that ten years of data was enough to provide an indication of trend as well as an estimate of magnitude.

A longer term data base such as twenty years is often accepted as a preferred time frame in which to develop regression formulas to reflect agricultural production responses. Statistically, twenty data points allow for greater degrees of freedom, but the statistical tests adjust for the number of observations in order to make a statistical test with ten observations equivalent and as valid as a statistical test with twenty observations. The coefficients (elasticities) developed in this study were compared to previous research which utilized a longer time period to enable some level of confidence in the results. This comparison also provided some range in production and price changes

following an MOP change. The acid test is: do the regression equations accurately represent the production and changes in production which occurred over the time period studied.

Changes in the production patterns of both grain and livestock occur much more rapidly today than in the past. The change from rapeseed to canola occurred over a two year period. Utility wheats advanced from an unknown to an accepted crop over a five year period. Semi dwarf barley varieties went from introduction to general acceptance over a five to seven year period. Improvements are occurring continually and are being tested and, if found to be beneficial, adopted by farmers quickly out of the farmer's need to be competitive and cost efficient.

The situation described above suggests that the ten year time period has certain benefits in the context of the task the impact committee undertook. This time frame does, however, have its weaknesses. Wheat production cycles of 12.5 years have been established (see Malmberg 1982) the eleven year time period would fail to reflect a full production cycle of wheat. It would, however, capture the ten and 3.5 year cycles identified for cattle and hogs. The greatest risk of using ten years of historic data instead of twenty or thirty is that long term trends may or may not be identified and if the model was to be used to predict occurrences in the future the result may under or overestimate the effects.

In that it was the intention of the impact committee to identify the changes which would have occurred over the past ten years if the MOP had been changed, without projections into the future, the ten year period was deemed to be acceptable. Data on a regional basis was limited and insufficient to enable the researchers to expand the study period beyond eleven years.

Analyzing a policy change is done in two parts. First, equations are estimated independently using Ordinary Least Squares to represent as accurately as possible, the decision making process of farmers. Using these equations, the model is used to mimic actual production patterns. Ideally, the equations closely mirror what actually happened. This set of equations and the results generated are called the base case. So, the base case is the econometric representation of reality and not the actual production figures though usually the numbers will be quite similar.

The second step is to "shock" the model with a policy change. In this case we are interested in how farmers will adjust their production patterns when they are faced with lower market prices for grains which result from a method of payment change. Because government payments to the railway decrease, it will cost the farmer more to ship grain to an export market. Because export market prices are determined by world market conditions, we assume that the farm gate price of grain falls by the full amount of the government payment to the railway. These new lower price levels for grain are fed into the model in place of the

actual series. This generates a new set of production figures for grain and livestock. This method of analysis is referred to as backcasting. We attempt to answer the question, how would the production patterns have changed if a lower market price for grains resulting from a MOP change had occurred 10 years ago.

The construction of the model is divided into two parts: a grain sector and a livestock sector. They are linked through the calculation of an off-Board barley price. A production response function for wheat, barley and canola was estimated for each region. Additionally an oat response function was estimated for Region 5. This section of the model determines production for grain. Production is calculated independently of the livestock sector. The econometric equations are used to generate a base line production for each crop and each year based upon the crop prices which actually existed in each year. Under the policy simulation the price of each grain is lowered as described above, and this lower price is fed into the equations to determine a new level of production. Thus, in the base case actual prices are used, while in the simulation reduced prices are used.

The change in production is measured between the results from the base case and the results following the policy change. It is assumed that historical yields would apply on any new acres brought into production. When an increase in production is projected, a test is made to determine that sufficient acres are available for that production. These acres would come from a reduction in the area seeded to other crops or summer-

fallow. The simulation also was designed to allow for crop rotations by bringing the results from one year forward to the next year.

The model also allowed the change in the grain price to impact the production and prices of livestock, if a linkage existed between these two commodities. Previous analysis has established that the price of grain influences the price of feeder calves, see Martin and Haack (1977).

The livestock sector of the model is driven off the barley price. A barley price equation is used to predict the off-Board barley price. The off-Board barley price is then used to determine the calf price and the feeder price. The calf price in turn is used to determine heifer replacements, steer and heifer inventory, and cow inventory.

The model was designed in a manner such that where the grain price affected the calf price, the new calf price could in turn influence the number of cattle if such a relationship existed. Such an influence would only occur where the calf price or grain price was a significant independent variable in the equation representing the specific class of livestock.

In the production of cattle, the time from a market situation which leads a farmer to increase or decrease a herd to the time at which the new production is measured is lengthy. As one example, from the time a farmer decides to keep a heifer calf for breeding until the offspring of this calf is fed out to slaughter weight can be three or more years. The

consequences of this are that eleven years of data may only allow for eight or nine years of analysis depending on the biological production pattern of the various classes of livestock. The biological cycle of hogs is much less, enabling farmers to increase production in eighteen months to two years. In the development of the equations the experience and knowledge of both staff and members of the Alberta Wheat Pool, staff of the Department of Agriculture, farmers from the various regions and the research teams own knowledge and experience, were employed in order to accurately determine and reflect with the model the factors which farmers use in making crop and livestock production decisions.

In order to assist the reader in interpreting the results reported, a range of responses is included where the response was found to be sensitive to the period studied. For those estimates which are not sensitive, the average reported is considered to accurately represent the findings. When interpreting the results of any model, it must be kept in mind that at best a model is a scaled replication of the actual occurrences. The data were employed to represent what actually happened. The model was designed in a manner which would accurately represent the data and the situations the data represented. This model has not been employed as a forecasting model, but instead the model has been applied to the same time period in which it was developed. As such, the model establishes trends and indicates direction of change which would have occurred in the past if the Crow Benefit had been paid to the farmers.

The results generated from the model then are new production figures for grain and livestock. These can be converted into revenue figures by multiplying the new production figures by the actual price that exists in that year. The production changes are assumed not to have any impact on price levels for that commodity. Producer and consumer surplus levels can be calculated and net welfare in both the livestock and grain industry determined.

Aside from the analysis conducted via the model, an analysis was conducted on a group of farms the Alberta Wheat Pool and Alberta Agriculture deemed to be representative of farms in the seven regions. These farms are referred to as "typical farms". This analysis involved acquiring financial and physical data on farms in the various regions and through the application of a linear programming (LP) procedure determining whether or not farmers would change their production patterns with change in the MOP. The objective of the LP was to maximize gross margin (return above cash costs).

All farm operations were constrained based on information received from Alberta Agriculture's production experts. These constraints included crop acres, crop rotations, the carrying capacity of pastures etc. Finances and farm machinery were constrained at the existing profile. The farms were allowed to rent land but the purchase of land was not allowed in the analysis. All data employed in the LP analysis was from 1986/87 cost of production studies.

The approach taken was to model each typical farm as it was in 1986/87 with crops, livestock, land, machinery and available finance. The changes in prices of both crops and livestock estimated by the econometric model were then incorporated into the data from each farm. Incorporating this change in prices, the LP model was then run to determine whether or not farmers would have a tendency to change their cropping and livestock production patterns.

The model reflects what changes farmers would make in their production patterns if they intended on maximizing gross margins. Unlike the econometric model, the LP results reflect the optimal allocation of resources. The results should accurately represent the trend or tendency of farmers following a change in the MOP.

The results of the typical farm/linear program analysis is reported under separate cover.

Description of the Regions

Seven regions of the province were isolated. These regions correspond to the Agriculture Reporting Areas (ARA) defined by Statistics Canada, and generally accepted by the agriculture profession. Region 1, (ARA 1), is located in the south eastern portion of the province from the U.S. border north to the Oyen/Consort area. Dryland farming in this brown soil zone is mainly wheat and barley with the land being summer fallowed every other year. Cattle ranching is predominant throughout the region.

This area has one of the lowest annual precipitation levels in the province, averaging 30 centimeters (12") per year. Irrigation in this region is limited. The Suffield Military Base occupies a substantial portion of the region. Cropping opportunities are limited due to the low moisture levels and significant evapotranspiration and evaporation. Wheat, the crop most suitable to short grass prairie conditions, has few competing crops.

Region 2 (ARA 2) includes the areas from the U.S. border north to Drumheller and bounded on the east by Brooks and on the west by Strathmore and Lethbridge. This region is Alberta's irrigation area and has the largest concentration of feedlots in the province. This region, with 110 to 120 frost free days, has approximately 85% of Alberta's one million acres of irrigated crop land. Crops grown under irrigation include soft white and durum wheats, canola, barley, alfalfa, corn, sugar beets and numerous vegetable and specialty crops. This area is again in the brown soil zone with annual precipitation levels of 35 centimeters (14"). In dryland areas wheat is grown extensively, with barley a viable alternative in the north and western portions of the regions. Dryland crop rotations, including summerfallow, prevail. Pivot irrigation systems have enabled farmers to continually expand their irrigated acres onto rolling land. This region, since the development of the feedlots, has continually been deficient in feed grains. Large cattle ranches occupy the non-arable regions in the central and southern portions of the region.

Region 3, ARA 3, follows Alberta's foothills from the U.S. border north to approximately Olds. The area is bounded on the west by the National Parks. The rainfall in this region averages 50 centimeters (21") per year, allowing for a vegetation which over the years has yielded a prolific thin black soil. Wheat and barley are grown extensively in the south and wheat, barley and canola and flax in the Calgary and north portion of the region. An extensive cattle grazing capability is prevalent along the entire foothills region, with much of this pasture being provincial government forestry grazing reserves which have pasturing charges based on a market related formula.

Region 4 (ARA 4) is situated in east central Alberta encompassing the area east of a north/south line connecting Redwater and Stettler to the Saskatchewan border. Soil zones in this region progress from brown in the southeast corner, through dark brown and thin black to black soil in the northwest. Precipitation ranges from 35 centimeters (14") in the southeast of the region to 46 centimeters (18") in the northwest segment. Frost free days range from 100 to 120 days. Farming in this parkland region consists of both livestock and grain, with many mixed farms. The soil and the climate enable farmers to grow all crops included in this study. In growing canola, care is taken in the rotation so as to prevent destruction of the crop by pests and disease, a two to three year rotation is practiced.

A very significant increase in the cow herd has occurred in this region. Many farms have large areas which are non-arable, but make excellent pasture.

With the mixture of grains and the availability of feedgrains hog operations are also prevalent throughout the region, especially in the north and northwest segment.

Region 5 lies to the west of Region 4, extending westward to the national parks. This region is primarily a black soil zone area with grey wooded soil on the western edge. Frost free period of eighty days in the western portion will restrict plantings of crops, especially wheat when a late spring is encountered. This region could be considered Alberta's dairy shed as dairy farms are prevalent throughout. Precipitation levels of 35 - 55 centimeters (18 - 22 inches) enable farmers to grow all crops studied in this analysis. Oat production is prevalent in this region, and has gained a reputation for exceptionally high quality "pony oats". The area is also noted for its forage production. Dairy, hogs, and canola all offer farmers in this region viable cash flow opportunities. Canola diseases and pests have limited the rotation of canola similar to that cited in Region 4.

Region 6 (ARA 6) follows a band from Cold Lake and St. Paul across to Whitecourt, Edson and the National Parks. This region has some of the highest rail freight rates in the province. Much of this area is grey wooded with frost free periods of eighty to one hundred days, and precipitation 35 to 50 centimeters (18 - 20 inches) per year. The short growing season limits the choice of crops and the area seeded into later

maturing crops such as wheat. Grades attained with late maturing crops such as wheat are often feed or the lower CW grades. Mixed livestock and grain farms prevail throughout the region. New land is being broken and added to the arable base each year. Bush or non-arable pastures have led many farmers toward extensive livestock operations, a trend which continues today.

Region 7 (ARA 7) is located in the Peace River area. The natural grass plains in this region were cultivated in the 1930s. Since that time extensive areas of forest have been cleared and grey wooded soil cultivated. This region with its short growing season of 80 - 100 frost free days, with some areas as low as sixty days, yields large volumes of grain, but grain which is often downgraded. Canola and forage seed production are very successful for farm operations throughout the region. Moisture levels are a moderate 35 to 46 centimeters (14 to 18 inches) per year, but relatively low temperatures prevent excessive evaporation and make the area well adapted to forage seed and canola production. The canola crushing operation near Grande Prairie offers significant support to this crop.

From settlement through to the late 1960s this region was primarily a mixed farming area with most farms having cattle and/or hog enterprises along with the cropping enterprise. Since the late 1960s, the area has tended toward crop production, and livestock operations have disappeared from many farms.

Cropping is limited by the shortness of the growing season, and the grades of wheat and later maturing grain are often down due to frost or deterioration in the swath. A study in the late 1970s found that over 90% of the barley harvested in the region graded feed. Such results reflect not only deterioration, but also the limitations on varieties which can be grown under the climatic conditions which exist. Land clearing continues to increase the cultivated area in this region.

II. MODEL SPECIFICATION

A. Structure of Commodity Models

Spatial commodity models of various types have been developed for agricultural markets in Canada. A Commodity model, as defined by Labys (1973), is a "quantitative representation of a commodity market or industry, where selected behavioral relationships reflect the supply and demand conditions in price determination as well as other related economic, political and social phenomena". Commodity models may not be uniform. In fact any differences in models will reflect the structure of a commodity market, and detailed information required to obtain model objectives. Some of these spatial models consist of optimizing the location of production and shipment patterns by employing both linear and non-linear (quadratic programming) techniques, others are classified as equilibrium econometric flow models.

Quadratic programming related to spatial studies utilizes endogenously determined prices and quantities to determine the most efficient location of production and optimal trade flows between of producing and consuming regions. Quadratic programming consists of three components: (1) A system of equations describing the demand for a commodity (ies) in a consuming region [EQN "(D sub i)"] and supply of a commodity (ies) in a producing region [EQN "(S sub i)"]. These equations consist of either quantity supplied and demanded as a function of prices or prices a function of supplies and consumption in the regions, [EQN "(P sub i#4 #or# P sub j)"]. Mathematically, these equations are expressed in quantity or price dependent form as:

$$D_i = \alpha_0 - \alpha_1 P_i$$
$$S_j = \beta_0 + \beta_1 P_j$$

$$P_i = \frac{\alpha_0}{\alpha_1} - \frac{D_i}{\alpha_1}$$

$$P_j = -\frac{\beta_0}{\beta_1} + \frac{S_i}{\beta_1}$$

(2) the distribution of activities over space, and (3) the equilibrium conditions. Although supply and demand specifications in a quadratic programming framework consist of a similar structure to that of equilibrium econometric models, the equilibrium process is more accurately represented through the maximization of profits. Profits in this context are defined as a positive price differential between two regions after deducting transportation costs. Profit maximization is obtained through the process of transferring commodities until demand equals supply in every spatially separated market. Further, quadratic programming allows the possibility of explicit constraints to determine the effects on prices and regional trade flows of given changes in supply and other exogenous variables. Quadratic programming models of this type were initially developed by Takayama and Judge (1964).

Constraints associated with trade between regions are applied such that demand in each region equals trade flows to that region and that production in a particular region will equal trade flows from that region. Welfare measures are not measured from the objective function, but rather from the individual demand and supply equations incorporated in the quadratic programming model. In summary, the main output from a quadratic programming model consists of determining:

1. Regional equilibrium prices;
2. regional supply and consumption; and
3. flows of interregional exchange.

Linear programming is an effective means by which spatial equilibrium problems are solved. The limitation of linear transportation models is the assumption of fixed demand and supply, that is, there is no reaction to supply and demand prices in each region. Hence, the solution obtained from the model cannot be viewed as a global optimal solution but a conditional optimal solution under predetermined demand and supply conditions.

The advantages of linear transportation models have been specified by Koo and Larson (1985) as being simple, thus enabling easy interpretation. Apart from linear transportation models being simple, they are very efficient in terms of computer operation. These models have the advantage of formulating a large-scale model with great detail. Another advantage of linear over quadratic programming models lies with the net effects of changes in transportation activities being easier to determine, since quantities demanded and supplied are fixed in a linear programming model.

Econometric commodity flow models, on the other hand, consist of export or import equations and/or price linkage equations or identities to determine prices and trade flows. Theoretically, equilibrium econometric models consist of two parts: 1. A set of two equations, demand and supply composed of endogenous, and predetermined variables. 2. An identity which assures that the market is "stationary" or in equilibrium. Statistical theory is then applied to the theoretical model. An advanced mathematical algorithm is then used to optimize the system. Equilibrium econometric models require more detailed information than quadratic programming models. From the previous discussion, for a given specification of supply and demand no significant difference should exist between a quadratic programming and econometric flow model in spatial equilibrium analysis.

B. Selected Empirical Methodology

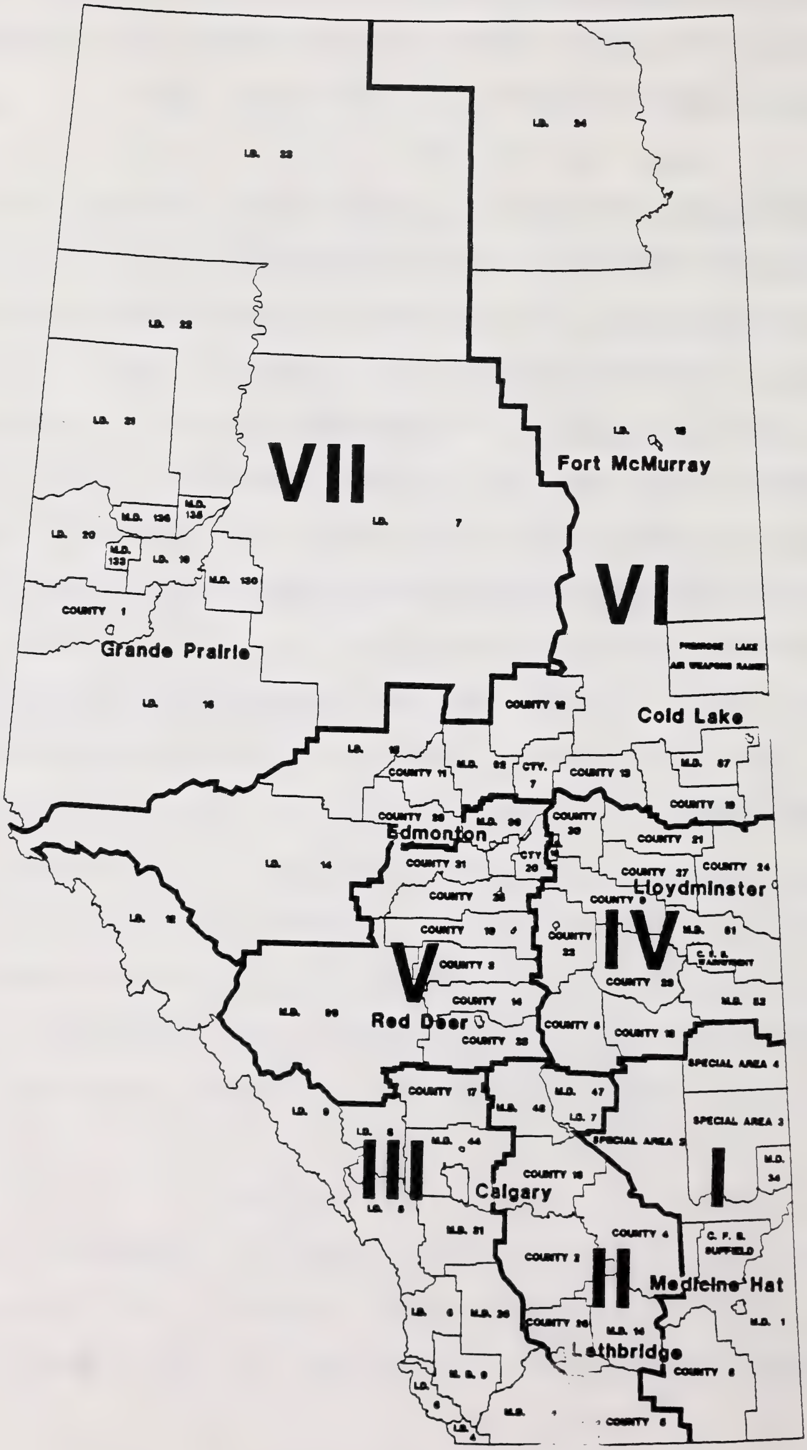
Alberta's agriculture exists in a complex environment. The problem was to construct a model capable of reflecting this environment in such a manner as to be useful in explaining production and trade flows on a sub regional basis. A model consisting of an econometric sub model integrated with a production simulation and linear transportation sub model is well suited for the interregional competition and policy environment in Alberta.

In this research all equations are estimated by ordinary least squares (OLS) techniques. All estimated functions are based on positive estimates rather than a normative (linear programming) estimate. This positive estimate is based on fitting a linear regression to historical

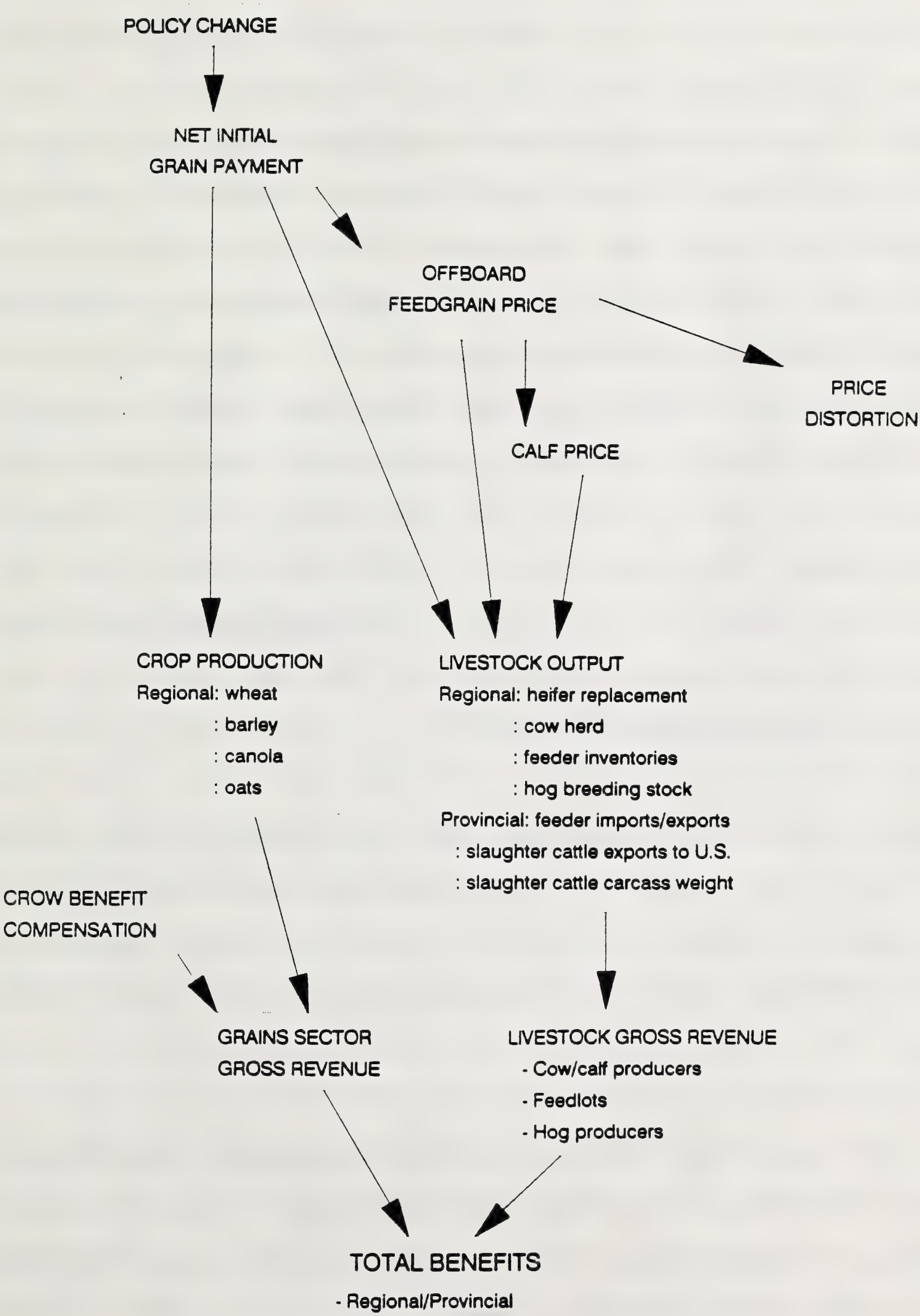
data with least squared error. These estimates are used to determine new production levels under different policy scenarios, thus assuming past policies and relationships among variables remain stable.

The baseline run consisted of two phases. First, quantities of grain and livestock were determined for each producing region by use of a production simulation sub model. The sub models reflected production/consumption patterns in seven sub regions in the province. Figure 1 depicts the regions used in the study. Off Board feed barley prices as well as calf and feeder prices were also estimated within the model. Secondly, quantities of grain surplus to the local grain requirements were made available to other regions or the export market. The flow of these grains was determined by means of maximizing gross returns through a linear program. Figure 2 displays the integration of the grain and livestock model. The baseline run is a simulation of the current production prices and trade flows.

AGRICULTURAL REPORTING AREAS



IMPACT MODEL



Following the baseline run, the simulation model was then "shocked" with a change in the producer freight rate (total freight charges) and in turn a reduced initial payment for Canadian Wheat Board grains. This change in the farm gate price of Board grains affects the production of grains and oilseeds. This reduced Wheat Board price in turn affects the price of off Board barley. The off Board barley price was found to be a significant factor in the price of calves and feeder cattle. A change in the price of calves was was found to be associated with changes in the cow herd. In this manner, a change in the freight rate has a ripple affect through both the grain and livestock sectors of the agriculture industry. The flow of grain between regions and deliveries to the export market were again established through the application of the linear program model. Local requirements were assumed to be fulfilled first, then export and inter-regional trade flows were estimated.

Regional welfare gains and/or losses were then calculated between the two scenarios. Since the model has excess demand and supply functions in all the consuming regions (export regions) and producing regions, respectively, it satisfies the spatial equilibrium conditions discussed earlier in this study.

The main output from the model consists of predicting the effects on prices and regional trade flows of given changes in supply and other exogenous variables. Output from the model consists of the following:

1. Sub regional equilibrium prices;
2. Sub regional supply and consumption; and
3. Interregional trade flows.

1. Data Selection

Estimation of parameters in this study were derived from 1978-1988 (N=11) annual data for three basic reasons. First, the prime concern of the study lies in providing a quantitative framework for long run policy decisions such as those related to transportation and pricing. Second, the use of annual data represents a least-cost method of achieving desired results since neither monthly nor quarterly data are plentiful for grain and livestock commodities. Third, periods of both stability and instability are covered.

2. Grain and Oilseed Supply Block

This commodity model consists of 22 supply responses. Supply responses for wheat, barley, oats, and canola for each sub region were estimated. Basically, the conceptual models for these supply responses are similar. These supply functions consist of production ('000 Bu.) as a function of the farm gate price ($/Bu.) and various exogenous supply shifters. For each sub region the farm gate price for Board grains represents the initial price minus transportation costs to the closest export port. Since the price of canola is not controlled by the C.W.B., a six month November future contract price was used ($/tonne) as the supply-inducing price. The November future price was used to indicate the market opportunities for canola during a particular crop year. This futures price was then converted into a farm gate price by deducting the appropriate transportation charges. Transportation costs are determined from the

export port to a central location in each sub region. These central points are illustrated in the following Table.

SUB REGION	CENTRAL LOCATION
1. Region 1	Medicine Hat
2. Region 2	Lethbridge
3. Region 3	Calgary
4. Region 4	Vermilion
5. Region 5	Edmonton
6. Region 6	Barrhead to St. Paul
7. Region 7	Fairview

The individual crop specifications rest on the premise that most planting decisions are made in the quarter prior to planting. It should be noted that the majority of crop supply functions in the literature have been estimated on an aggregate basis, thus limiting the usefulness in comparing elasticities and significance levels of the various explanatory variables to the results obtained in this study. In this study, the supply responses take the following general form:

$$A_{ij} = g(P_{ij}, S_{ij})$$

Where:

A_{ij} = Production of crop i in region j.

P_{ij} - **Farm gate price of crop i in region j.**

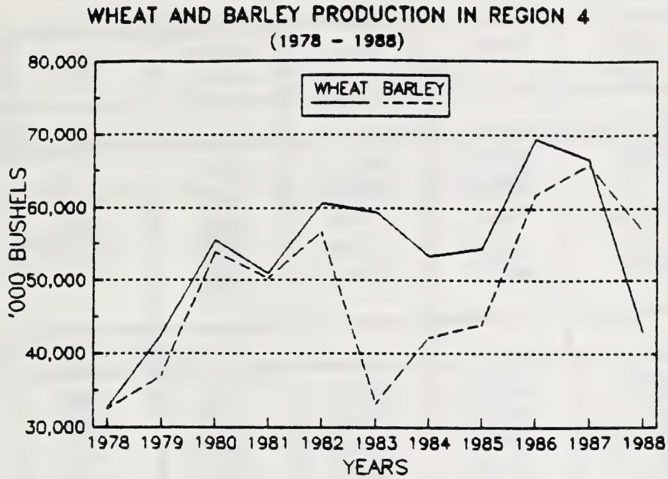
S_{ij} - **Exogenous supply shifters of crop i in region j.**

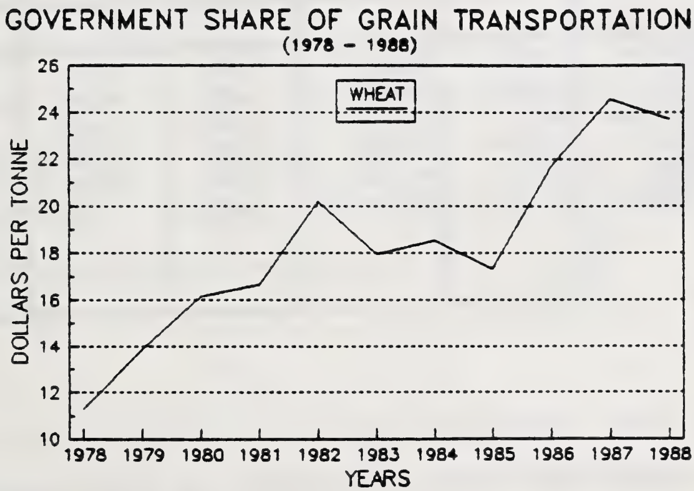
One exogenous supply shifter included in the intercept term of the grain supply functions was a government subsidy variable. This variable represented the level of government contributions towards grain shipments to export position in Alberta. In the base case, Board prices implicitly contain this subsidy through a higher net initial payment. Therefore it would seem that this variable (subsidy) is an attempt to measure forces which are similar to those measured by the price variable (see equations in following Table). Following is a discussion on this point.

The subsidy variable in the grain supply functions was used to test the affect of a government subsidy on grain production. The hypothesis tested was that producers react differently to price than to a subsidy in allocating their resources.

Given that freight subsidization is based on the level of grain production it was anticipated that the coefficient on this variable in the supply function would not only reflect this subsidy but an annual trend. Following is a graph showing wheat and barley production and the level of government contributions toward grain shipments on a per tonne basis. This diagram indicates a similar trend in grain production and in the government subsidy. This issue was dealt with in two ways: 1) The correlation matrix of variables was used to check the association between

the two variables (trend and subsidy) and also the correlation matrix of coefficients was used to detect any multicollinarity between these variables in the function, and 2) Cases where multicollinarity existed the regression was rerun to include a) prices without grain transportation subsidy (gtran) or a linear trend variable, b) prices with gtran and no linear trend, c) prices with a linear trend variable. The F stat was used to determine which variable (grain transportation or trend) increased the significance of the overall equation. The results for Region 4 given these runs are included in the following Table. It can be seen that the F stat is the greatest when grain transportation is included in the analysis. By not including either a trend or subsidy variable in the analysis an increase in the price coefficients results. Therefore producers reactions towards a subsidy would be incorporated in these price coefficients. This would assume that producers react similar to price and a subsidy in allocating resources. By removing the subsidy from price, a decrease in the price coefficients was found. The results suggest different coefficients for the subsidy (gtran) and own - price parameters when gtran is introduced, thereby suggesting different reactions towards price and subsidy. This specification also permits better estimates on the price coefficients (ie. a lower standard error on the price coefficient) which slightly improves the results. The specification used in this analysis provides better estimates (F , T values and lower standard errors) than without a gtran variable.


WHEAT AND BARLEY PRODUCTION IN REGION 4
(1978 - 1988)
WHEAT BARLEY
'000 BUSHELS
80,000
70,000
60,000
50,000
40,000
30,000
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988
YEARS


GOVERNMENT SHARE OF GRAIN TRANSPORTATION
(1978 - 1988)
WHEAT
DOLLARS PER TONNE
26
24
22
20
18
16
14
12
10
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988
YEARS

Estimation	coeff. name	coeff.	std. error	t-ratio	elast.	F-stat
a	NINTW	15753	2431.5	6.47	1.11	11.71
	FUT	-4762.5	1659.3	2.87	-0.64	
	RNFALL	262.67	73.93	3.55	1.00	
	BAC	-49.46	15.64	3.16	-0.91	
	CONST.	23233	23672	0.98		
b	NINTW	13804	1781.3	7.75	0.98	22.10
	FUT	-4121	1144.8	3.60	-0.56	
	RNFALL	190.4	56.08	3.40	0.72	
	BAC	-47.41	10.61	4.47	-0.87	
	GTRAN	884.83	310.63	2.85	0.31	
	CONST.	22432	16014	1.40		
c	NINTW	14559	2152	6.76	1.03	13.82
	FUT	-4200	1433.9	2.92	-0.57	
	RNFALL	241.2	63.51	3.79	0.92	
	BAC	-48.74	13.22	3.69	-0.89	
	YEAR	767.66	415.44	1.85	28.48	
	CONST.	$-0.15*10^{07}$	$0.82*10^{06}$	1.82		

In Region 1 a linear trend (year) was used in the canola supply function instead of a grain transportation variable. The grain transportation variable was mainly a linear trend when estimating canola production. A linear trend in this equation provides a better estimate on grain production. It maybe that the gtran variance in other equations are possibly a trend variable. While this may suggest considerable caution in interpreting this subsidy variable. Impacts in this study are entirely driven through price with government contributions levels left constant.

Therefore the results of this subsidy variable on production has no apparent consequence for estimating an impact because of the producer method of payment change. It appears that gtran causes a minimum own price parameter, thereby creating price driven aspects that are lower bound than if gtran were not in place.

3. Grain Production Responses

WHEAT

Changes in the production of wheat were primarily related to the wheat initial payment or the prices of competing grains or oilseeds. The crow benefit payment and fallow acres were also found to be significant factors directing the production of wheat. The extreme drought conditions which have been prevalent in southern Alberta were also useful in estimating past production patterns of wheat in the affected regions.[1]

BARLEY

Barley response in all regions was found to be significantly related to the crow benefit payments and the price of competing crops, primarily canola. Fallow acres and rainfall were also found to be highly related to barley production in certain regions.

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1 Appendix A, contains all grain supply specification for all regions in Alberta.

CANOLA

The level of canola production in each region in Alberta was also found to be significantly related to the crow benefit payment and the price of competing crops (wheat and barley). Barley and Canola stocks were also found in particular regions to be significant in determining canola production.

4. Livestock Inventory Block

a. Introduction

This section traces the methodology used to develop the Alberta livestock model. This project was primarily concerned with the supply side of the Alberta livestock industry. Purely competitive theory was viewed as best describing Alberta's livestock industry.

The linkages among beef production decisions are complex and region specific given geographical differences describing local production possibilities and economic conditions. Martin and Haack (1977) provide a framework outlining the "sequential decisions made by cow-calf and feed lot operators..." as well as the role of prices in the decision making process.(M&H 1977) Based on their research and in compliance with the guiding principles as set forth by the steering committee for this project, a model of the Alberta livestock industry was developed.

For the most part, regional livestock numbers for beef cows, replacement heifers, feeder steers and heifers, and hog breeding stock were only available from 1979 onwards. No supply management industries were analyzed in this study, as these industries could most readily adopt to such a change. Interprovincial livestock trade data was only available for feeder exports to Ontario and feeder imports from Saskatchewan. Since these markets comprise the majority of Alberta's trade activity, the lack of data for other interprovincial movements was not viewed as a limitation. Reliable data on shipments of slaughter cattle to the U.S. was only available since 1984, such that quarterly data since 1984 was used in the estimation to provide for greater degrees of freedom. Very little livestock movement from the U.S. to Alberta occurs, such that no estimations on this trade flow were attempted in this study.

b. Model Specification and Estimation

The livestock industry can be viewed as a chronological linkage of decisions, whereby present decisions are in part bound by past decisions in not only the variable being estimated but also by previous decisions in other enterprises or sectors of the agricultural industry. The livestock industry is linked to the grains sector, government initiatives, and macroeconomic factors, as well as to other livestock sectors both within and outside Alberta's market. The following sections provide a detailed description of the model, with specific regional equations provided in Appendix A. The sections are organized in a manner whereby the most distant decisions which affect current supply are discussed first.

4.1 CALF PRICES

Calf prices are one of the most important factors influencing decisions in feedlot and cow-calf operations. The demand (price) for feeders is viewed as being dependent upon the last quarter's calf price, the price for finished cattle in the current quarter, the previous quarter's barley price, and the payment per tonne made under the Crow Offset Program's.[2] An adaptive expectations model which incorporates a lagged dependent variable as well as a moving average error was used to develop the quarterly price equations. The structure of the price equations was established to reflect the view that feedlot operators establish the price for calves and feeder cattle. The relationship is as follows:

$$RP_{i,t} = \alpha + B_1 RP_{i,t-1} + B_2 SPAB_t - B_3 AGLE_{t-1} + B_4 CBOP_t + \epsilon_t \qquad (1)$$

$$\epsilon_t = \mu_t - \lambda \mu_{t-1}$$

where:

RP = calf price in region i at time t;

SPAB = Alberta direct to packer steer price at time t;

AGLE = Lethbridge off-board barley price;

CBOP = Alberta Crow Benefit Offset Program and previously the Alberta Feed Grain Market Adjustment Program.

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2. This includes payments under the Alberta Feed Grain Market Adjustment Program (AFGMAP) as well as those under the Alberta Crow Benefit Offset Program (ACBOP).

The time period for estimation was from the first quarter of 1978 to the third quarter of 1988. Two regions, southern Alberta, and central and northern Alberta, were used in the analysis as data was not available for all seven regions for the time period studied. The southern Alberta calf price represents regions 1, 2, and 3, while the central and northern calf price represents regions 4, 5, 6, and 7. Estimations for both calf (500 - 600 lbs.) and heavy feeder (800 - 900 lbs.) price functions were made in the study. However, only calf prices were used in further equations.

The current steer price was hypothesized to reflect the expected steer price feedlot operators would expect to receive for calves bought in the current quarter and then sold in the future at slaughter weight. The off-Board barley price used in the analysis was the Alberta Grain Commission asking price for barley in Lethbridge. Lethbridge was viewed as the central price setting market for barley in Alberta. Different lags for barley were tried in the estimation, from which a one quarter lag was found to best represent the price used by feedlot operators in their bids for calves and feeders.

Unlike previous work in this area of research, subsidies were quantified and tested as predictors in the equation. Both ACBOP and Tripartite payouts were tried in the estimation, with the Tripartite variable being dropped due to the lack of data points since the first Tripartite payout in the fall of 1987. The use of ACBOP as a predictor to price suggests that payments made to feedlot operators are in part passed on to cow-calf producers in the form of higher calf prices.

The above relationship was estimated using an autoregressive estimation procedure with a lagged dependent variable. As with all the relationships discussed in this chapter, estimated coefficients, statistical measures of goodness of fit, and validation procedures for the calf and feeder equations are provided in Appendix A.

4.2 REPLACEMENT HEIFER INVENTORY

A farmer can alter the size of his cow herd by adjusting the rate at which he retains heifers for breeding as well as by the rate at which he culls cows for slaughter. A change in method of payment was hypothesized to be an incentive to retain heifers for breeding and consequently increase the size of the cow herd over time. Regional data on cow culling rates was not available but provincial cow slaughter data was available. A July 1st inventory for replacement heifers was used in this study. In general, the replacement heifer relationship can be expressed as follows:[3]

$$HI_{i,t} = \alpha + B_1 HI_{i,t-1} + B_2 RPW_t + B_3 Z_t + \epsilon_{i,t} \qquad (2)$$

$$\epsilon_{i,t} = \mu_{i,t} - \lambda \mu_{i,t-1}$$

3. Regional variations in the replacement heifer, cow, feeder and hog inventory specifications are presented in Appendix A.

where:

HI = replacement heifer inventory, July 1st, for region i at time t;

RPW = regional calf price from previous year's fourth quarter divided by the region's net initial for wheat lagged one year;

Z = other region-specific exogenous variables.

The period for estimation was 1979 to 1988 for each of the seven regions. The calf price from the previous year's fourth quarter, during which most calves are weaned and sold to feedlots, was viewed as the major factor contributing to a cow-calf operator's decision to retain more or fewer heifers for breeding. However, Alberta's cow herd is predominantly on mixed grain and livestock farms where, over the long run, the alternative for those resources (land, labour and capital) currently in livestock production is to be in grain production. As such, a ratio between the calf price and the net initial (CWB initial less transportation) for wheat (barley in region 7) was used to reflect the relative profitability of the two enterprises.[4]

Upper limits, to conform with capacity constraints on farms in the regions, were placed on the replacement heifer equations. A stable cow

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4. While it would have been preferable to obtain separate coefficients for the calf price and net initial, the variables when not used in ratio form presented multicollinearity problems in the estimation.

herd typically has a 14 to 18% heifer retention rate. Gracey found the Canadian cow herd to increase annually by up to 11% during an expansionary phase.[5]

4.3 BEEF COW INVENTORY

Alberta's cow herd lies predominantly in region's 3, 4, 5, and 6, where over the course of this century there has been a gradual shifting of the cow herd from the traditional southern regions to the central and north-central regions. The Peace River region's cow herd remains relatively low at approximately 5% (77 000 Head) of the Alberta cow herd (1 366 000 Head).

The decision to retain or cull cows can be viewed as a seasonal decision; fall and spring. In the fall as cows are pulled off the pasture, the farmer makes a decision whether or not to cull open (not in calf) or poorly conditioned cows. In general, cows kept in the fall will be held over the winter in the hope of them bearing a calf. Come springtime, the farmer traditionally decides whether or not to keep those cows which did not bear a calf. This seasonal decision making process had to be considered in the development of the cow inventory relationship, which is based on July 1st data for all cattle numbers.

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5. Gracey, Charles, "The Cattle Cycle," Canadian Cattlemen's Association, 1981

The decision to retain or cull cows can be viewed as a recursively linked decision making process, whereby the farmer is in part bound by past decisions on the cow and heifer herd due to resource allocation and allottment.[6] As well, at the decision point an expectation of price based on previous calf prices was hypothesized to be factored into the decision. The general form of the regional beef cow inventory relationship can be shown as follows:

$$CI_{i,t} = \alpha + B_1(CI_{i,t-1} + HI_{i,t-1}) + B_2 RP_{i,t-j} + B_3 Z_t + \mu_{i,t} \qquad (3)$$

where:

CI = region i beef cow inventory, July 1st at time t;

HI = region i replacement heifer inventory, July 1st at time t;

RP = fourth quarter calf price;

Z = region-specific variables.

The period for estimation was from 1979 to 1988 for each of the seven regions in Alberta. As mentioned earlier, the cow inventory in the current year was viewed to be bound in part by previous decisions on the cow herd as well as on the replacement heifer inventory. Region-specific variables are presented in Appendix A. The estimation of the above relationship was completed using either simple ordinary least squares regression or a first order corrected for autocorrelation estimation procedure.

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6. For a good review of recursively linked models as applied to beef supply response see Martin and Haack (1977) or Bobst and Davis (1984)

4.4 FEEDER STEER AND HEIFER INVENTORY

The feeding of steers and heifers to slaughter weight has, over the last 10 to 15 years, come to be a specialized activity. At present, industry sources suggest over 80% of all cattle are fed to slaughter weight in a feedlot operation. Region 2, the Lethbridge area, is the primary feeding area in the province with approximately 25 to 30% of the total feeders on hand July 1st. Regions 3, 4, and 5 each account for 15 to 20% of the feeders, while regions 1, 6, and 7 are relatively minor feeding areas.

As with the cow herd, feeding activity in the province declined over the period 1975 to 1986, after which there has been a surge in feeding activity. Given this direct relationship between the cow herd and feeding activity, it was hypothesized that an increase in the cow herd would make available more calves for feeding and thus increase the feeder inventory numbers.

One of the major input costs to the feeding sector is the cost of feeder cattle. It was hypothesized that as calf prices increase, the demand for feeders decline. Given the structure of the calf price equation, it was presumed the influence of both steer and barley prices was embedded in the calf price. In general, the regional feeding inventory relationship can be shown as follows:

$$FDR_{i,t} = \alpha + B_1 CI - B_2 RP_t + B_3 Z + \epsilon_{i,t}$$

$$\epsilon_{i,t} = \mu_{i,t} - \lambda \mu_{i,t-1}$$

where:

FDR = regional feeder steer and heifer inventory on farms July 1st;

CI = cow inventory July 1st;

RP = previous fourth quarter calf price for region i;

Z = region-specific variables.

The period for estimation was 1979 to 1988 for all seven regions. Different lag specifications for the calf price were tried, from which it was found the fourth quarter calf price from the previous year provided the best fit.

4.5 PROVINCIAL EXPORTS OF FEEDER CATTLE TO ONTARIO

Traditionally, Alberta has been a large exporter of feeder cattle to Ontario, with annual exports ranging from 105,000 to 190,000 head over the period 1979 to 1986. However, over the last two years, annual exports to Ontario have dropped considerably to approximately 65,000 head. The relative feeding costs between Alberta and Ontario was hypothesized to influence feeder exports to Ontario.

As well, calf prices tend to reflect buyer demand. An alternative market for Ontario's feeder cattle buyers is Saskatchewan. Consequently, it was hypothesized the relative calf prices between Alberta and Saskatchewan would reflect demand for Alberta feeder cattle. The feeder exports to Ontario relationship can be shown as follows:

$$EXPONT_t = \alpha - B_1 CRNBAR + B_2 RPSKSPR + \mu_t \quad (5)$$

where:

EXPONT = annual feeder cattle exports to Ontario;

CRNBAR = Ontario corn to Alberta feed cost ratio. Previous year fourth quarter prices. Alberta feed cost is the Lethbridge off-board barley price less the Crow Offset Programs;

RPSKSPR = Alberta minus Saskatchewan calf price spread. Previous year fourth quarter prices.

The period for estimation was 1979 to 1988. The equation was estimated using ordinary least squares regression.

4.6 PROVINCIAL FEEDER IMPORTS FROM SASKATCHEWAN

Over the period 1979 to 1986, feeder imports from Saskatchewan generally declined from a high in 1980 of nearly 210,000 head to a low of approximately 130,000 head in 1986. Since 1986, feeder imports have risen to the 175,000 -200,000 head per year range.

The price of calves (feeders) and the cost of feed represent the two main variable costs in a feedlot operation. As such, the movement of feeder cattle from Saskatchewan into Alberta was hypothesized to be a function of the calf price spread, as well as the feed cost spread between the two provinces. The relationship can be represented as follows:

$$SKEXP_t = \alpha + B_1 RPSKSPR - B_2 SKFDSPR + \mu_t \quad (6)$$

where:

RPSKSPR = Alberta minus Saskatchewan calf price spread. Previous year fourth quarter prices;

SKFDSPR = Alberta minus Saskatchewan feed cost spread. Previous year fourth quarter prices.

The time period for estimation was 1979 to 1988. The above relationship was estimated using ordinary least squares regression. Alberta's feed cost included the Crow Offset Programs, while Saskatchewan's feed cost was their provincial average barley price.

4.7 PROVINCIAL EXPORTS OF SLAUGHTER CATTLE TO THE UNITED STATES

Prior to 1984, the U.S. market for Alberta's slaughter cattle was relatively unimportant, with annual shipments estimated at less than 20,000 head.[7] Industry experts suggest the packing plant strikes in 1984 provided an incentive to feedlot operators to look to the U.S., particularly the Pacific northwest, as an alternative market to sell slaughter cattle. Since the strikes of 1984, shipments to the U.S. have increased to more than 100,000 head per year.

The main market for Alberta slaughter cattle in the U.S. is the Pacific northwest, or Washington area. This market tends to prefer cattle fed to

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7. Although data prior to the implementation of Alberta's Brand Inspection program in 1984 is not very reliable, annual shipments from the late 1970's to early 1980's have been estimated at less than 20,000 head.

heavier weights than those desired by Alberta packing plants. As such, the decision to sell into the U.S. market was hypothesized to be a function of both the Alberta - Washington steer price spread and the cost of feeding. The relationship can be shown as follows:

$$SLEXP_t = \alpha - B_1 STRSPR_t - B_2 FDCOST_{t-2} - B_3 DUM4 + B_4 DUM87 + \epsilon_t \quad (7)$$

$$\epsilon_t = \mu_t - \lambda\mu_{t-1}$$

where:

SLEXP = quarterly slaughter cattle exports to U.S.;

STRSPR = quarterly Alberta steer price ($CDN) minus Washington steer price ($US);

FDCOST = quarterly Alberta feed cost;

DUM4 = fourth quarter dummy variable;

DUM87 = dummy variable for 1987 = 1, 0 otherwise.

Quarterly data from 1984 to 1988 was used in the estimation. The equation was estimated using a first order autoregressive estimation procedure. A fourth quarter dummy variable was used to account for seasonality. A dummy variable for the second quarter of 1987 was included to account for abnormally large shipments to the U.S. during that quarter. These shipments were to be the result of a temporary shortage of finished cattle in the U.S.[8]

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8. Alberta Agriculture, "Cattle Situation and Outlook," Market Analysis Branch, Alberta Agriculture, July 1987.

4.8 CARCASS WEIGHT OF CATTLE SLAUGHTERED IN ALBERTA

Over the period 1979 to 1985, the mean warm carcass weight of cattle slaughtered in Alberta ranged between 590 to 625 pounds. Since 1985, carcass weights have gradually increased to the 675 to 700 pound range. As feeding costs decline (increase), it was hypothesized there would be an incentive to feed cattle to larger (smaller) weights. As well, it was further hypothesized that as financing costs increase, there would be a disincentive to feed cattle to larger weights. The carcass weight relationship developed for this study can be shown as:

$$CWT_t = \alpha - B_1 FDCOST_{t-2} - B_2 INTR_t - B_3 D2 + \epsilon_t$$

$$\epsilon_t = \mu_t - \lambda\mu_{t-1}$$

where:

CWT = quarterly mean warm carcass weight;

FDCOST = quarterly Lethbridge feed cost net of the Crow Offset;

INT = quarterly bank of Canada interest rate.

The above relationship was estimated using quarterly data over the period 1979 to 1988. The equation was estimated using a first order corrected for autocorrelation autoregressive estimation procedure.

4.9 REGIONAL HOG BREEDING STOCK INVENTORY

Alberta's hog breeding stock inventory has been on a general upward move since the mid - 1970's. Over this period, hog breeding numbers have risen

from 94,000 head in 1976 to 187,000 head in 1988. Within Alberta, regions 2 and 5 account for approximately half of the hog breeding numbers, while regions 1 and 7 each account for less than 5% of total numbers.

Most hog operations in Alberta are farrow to finish enterprises, with few being specialized in feeding weaners to slaughter weight. From this, it was hypothesized hog operators would base their inventory decision on both feeding costs and hog slaughter prices. The hog breeding stock relationship can be represented as follows:

$$HOG_{i,t} = \alpha + B_1 HOG_{i,t-1} + B_2 HOGBAR_t + B_3 DUM84 + \epsilon_{i,t} \qquad (9)$$

$$\epsilon_{i,t} = \mu_{i,t} - \lambda\mu_{i,t-1}$$

where:

HOG = regional hog breeding stock inventory;

HOGBAR = hog to barley ratio. Fourth quarter index 100 hog price lagged one year divided by feed cost for first quarter of current year;

DUM84 = dummy variable for 1984 = 1, 0 otherwise.

Annual data from 1977 to 1988 was used in the estimation procedure. The above relationship was estimated using a first order corrected for autocorrelation procedure. Different lags for both the hog price and the feed costs were tried, with the previous year's fourth quarter hog price and the first quarter current year feed cost providing the best fit. A dummy variable for the province's Hog Assurance Program was included to account for the sudden increase in hog numbers from 1983 to 1984.

4.10 COMPARISON OF ESTIMATED LIVESTOCK ELASTICITIES TO PREVIOUS RESEARCH.

The lack of a longer time series for the seven regions analyzed in this study was of concern to the researchers because of the small degrees of freedom. Wherever possible, a comparison of the elasticities provided in the literature was compared to those derived in this research. The following table provides a comparison of the elasticities estimated in this study to those from previous research in the livestock sector.

The elasticities derived in this study are within the ranges estimated in previous research on the livestock sector. The most recent research, completed by Martin and Meilke in 1986 using a 25 year time series, estimated the short run price elasticity on Western Canadian cow inventories to be 0.09. The range in price elasticity in this study of 0.11 to 0.13 is comparable, given that regional elasticities were anticipated to be higher than aggregate estimates.

The elasticities of price transmission from steer price to calf price and from feed cost to calf price estimated in this study are similar to those estimated by Martin and Haack (1977), who used 1963 to 1975 as their time frame.

TABLE: COMPARISON OF ESTIMATED ELASTICITIES TO PREVIOUS RESEARCH.

	Short Run Price Elasticity of Supply	
Martin and Haack 1977 West Cow Inventory	0.20	
Martin and Meilke 1986 West Cow, Bull Inventory	0.09	
This Study 1989 Alberta Regional Cow Inventory	0.11 to 0.13	
Elasticities of Price Transmission:		
	Steer Price	Feed Cost
Martin and Haack 1977 Calf Price	0.57	-0.26
This Study 1989 Calf Price	0.59	-0.24

5. Off-Board Barley Price Functions

Price equations for each of the seven regions in Alberta were developed. The basic structure of these price functions was adapted from Malmberg [1987].[9] Malmberg [1987] found that net initial payments[10], adjustment payments, final payments and a logged stocks-use ratio were significant in determining off Board barley prices. In this research an adaptive expectations model[11] was developed on a monthly basis during the period 1978-1988. The conceptual model for all sub regions in Alberta are similar. It was found on a sub regional basis that Alberta Grain Commission off Board barley prices ($/Tonne) are a function of net initials ($/Tonne), adjustment payments ($/Tonne), a logged stocks-use ratio and a lagged one month off board barley price ($/Tonne).

6. Demand Block

In order to be consistent with the supplies in the spatial equilibrium analysis, demand must represent derived demand. It would not be meaningful to intersect a market demand function with a farm supply function.

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9. Malmberg (1985) developed a provincial annual off-Board barley function for Alberta.

10. Net initial payments are equal to the barley initial price minus producer freight, dockage and handling charges.

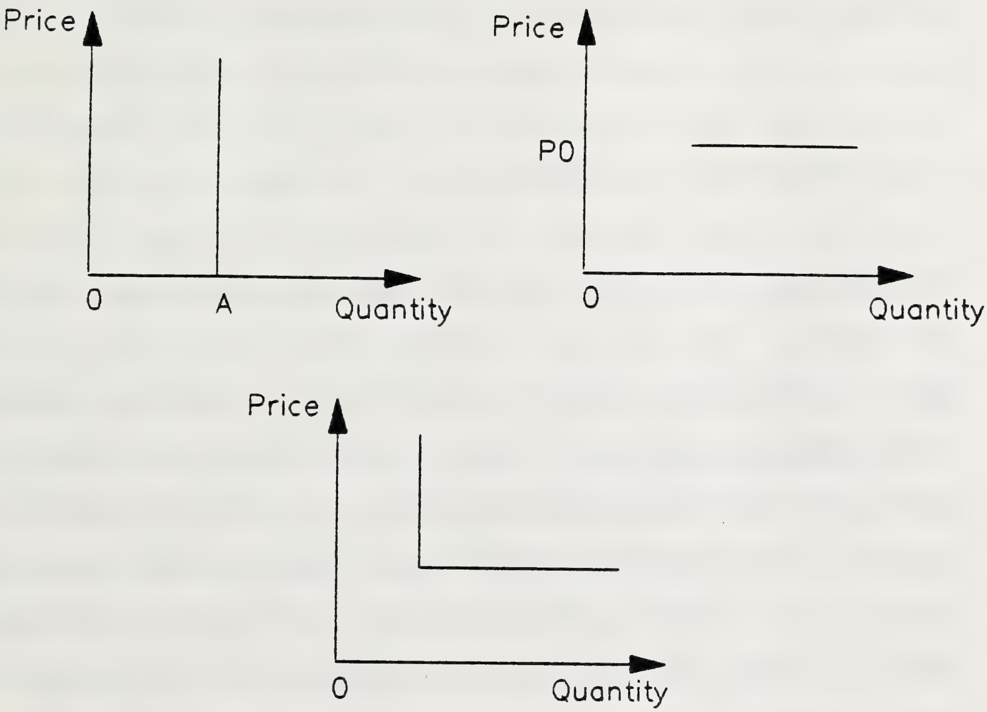
11. For a good review of the theory of adaptive expectations, see Nerlove (1958).

Demand in the barley market at the farm level consists of demand for on-farm feed use and export demand. Demand for on-farm feed use is primarily the feed grain requirements for livestock in a particular region. In order to measure aggregate feed grain requirements accurately, predicted livestock inventories on farms were converted to a standard basis known as "grain consuming animal units" which indicate the annual grain requirements for each class of livestock. Basically the feed grain consuming factors are multiplied by the livestock inventory numbers in a particular region to determine feed grain requirements.

Stocks of grain available for export at the farm gate are basically a function of total production minus feed grain requirements. This assumes that each sub region consumes its own product and exports the remainder. Therefore, the annual sub regional export demand functions are perfectly elastic.

In summary, total derived demand for barley is represented by a horizontal summation of feed use and export demand. This is represented in Figure 3. In this diagram, OA represents the amount of feed grain requirements, exports are primarily a function of farm gate prices, and total summation results in a kinked demand function. In this study this function is moved along the supply function in order to determine the quantities available for export from each region in Alberta.

Figure.3: Total Derived Demand for Barley *



Derived demand for wheat consists primarily of quantities available for export and is represented by one point, total production. This tends to be consistent with the barley demand for exports at the farm level. This is only a slight simplification because small amounts of wheat are diverted into the domestic market (17 percent of total production in 1984-1985, consisting of wheat for milling purposes as well as feed).

Canola producers who ship their product for export from Canada also employ the transportation cost advantage set under the Western Grain Transportation Act. Derived export demand for canola, as with wheat, is specified to be a function of total canola produced.

7. Production Simulation Sub Model

The above specifications of supply for both grain and livestock represent the conceptual model that was estimated. The linking of the different grains -canola, wheat, and barley and livestock inventories - among the seven producing regions was then simulated. All supply equations for grains were expressed in two dimensions, in order to simplify the simulation. The mathematical derivation of the two dimensional function consists of all variables collapsed into the intercept term except for the own price (slope of the equation). Mathematically these equations are as follows:

$$Q_{ij}^{t} = \alpha_{ij} + \beta_{ij} P_{ij}^{0} \qquad i = 1,2,\ldots 7; \; j = 1,2,\ldots 7 \qquad (3.14)$$

Where: Q_{ij}^{t} = Equilibrium quantity supplied in the i^{th} region and j^{th} crop in time period t.

α_{ij} = All exogenous variables in the i^{th} region and j^{th} crop.

β_{ij} = Slope of the function for the i^{th} region and j^{th} crop.

P_{ij}^{0} = The equilibrium price for the i^{th} region and j^{th} crop in time period t.

Linking of all supply functions in the production simulation sub model occurred through cross prices or the intercept term in all two dimensional equations. Livestock inventories were linked through net initial payments, off board barley prices, and various exogenous demand and supply shifters. In the baseline run actual prices and exogenous variables were inputted into the production simulation sub model. Following the baseline run a price policy change was implemented. New prices were than calculated. * These new prices cause a shift and a movement along the supply function.

Initially, prices and exogenous variables in each simulation year (1978-1988) were set at actual levels in order to test for predictability of the various functions and to determine the equilibrium levels in each sub region and for each commodity market. This is consistent with the theory of competitive pricing. In a competitive market, there can only be one price-quantity equilibrium point per unit of time. The validity of this latter statement depends upon the assumption that buyers and sellers have "perfect knowledge". This means that the price is known with certainty in all available markets. This is reasonable for the western Canadian grains economy since all producers know the level of initial prices and/or transportation costs of their product to market usually before planting decisions are made.

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* In the case of a lagged dependent variable, the actual value was used in the baseline scenario. In the pay the producer run, the predicted value was employed. An example would be lagged barley acres in the Region 1 wheat equation.

Production constraints on each grain and oilseed crop in each sub region are included in the simulation model. Production constraints are set at levels equivalent to the maximum number of acres that historically have been seeded to a specific crop in each region multiplied by the maximum yield (Bu./Ac.) that has occurred for that crop in each sub region. This represents the potential production opportunities in a particular region.

All collapsed supply functions are used to determine different equilibrium quantities (for wheat, barley, and canola) from performing different pricing policy options. By subtracting total sub regional domestic requirements in the barley market results in total available exports from each location. Exports of wheat and canola from each sub region are equivalent to total production in each sub region. Quantities of barley exports are used in a transportation linear programming sub model to determine optimal barley flows throughout Alberta.

8. Grain Flow Sub Model

In the linear grain flow sub model the total amount of barley shipped from each region is viewed as total quantities available for export in each producing region. In this sub model gross returns from grain flows are maximized. This method is used normatively to assess how the output of each sub-region "should" flow to the excess demand areas if competitive conditions are to be maintained. In this sense, this method is appropriate to analyze problems of comparative and interregional competition because of proposed changes in grain transportation policies.

Since supply responses are taken account of outside the linear transportation model, the limiting assumption of fixed demand and supply becomes somewhat less limiting in this model. Also, the assumption of proportionality between resource use and each activity is realistic in the western Canadian grains economy. In this sector, under W.G.T.A., costs of shipping grain remain constant per tonne over the total quantity shipped during a specific crop year.

9. Revenue Analysis

After application of the barley flow sub model, optimal grain shipments are used to determine total revenue. This revenue is determined for each sub-region in the analysis and is also aggregated on a provincial basis. This analysis calculates and compares the revenues associated with shipments under the baseline analysis and a producer payment policy option. This will determine the total impact on producer revenues from both domestic and export sales of barley.

10. Welfare Effects

An assessment of welfare effects from the producer payment are calculated from the sub regional supply responses and predetermined demand levels. Producer and consumer surplus are calculated. Net welfare in both the livestock and grain industry are determined. This net welfare will

determine the "well being" of both sectors in Alberta following a producer payment change.

III. RESULTS OF SIMULATION MODEL

A. Crop Production Responses from a Change in the Method of Payment

With a change to a pay the producer method of payment of the Crow Benefit it is anticipated that crop production patterns may change. In order to determine whether or not a change in production would occur the simulation model was run to reflect the current payment to the railways, and then a run was made which would reflect a producer payment. The difference between these two runs was the change in the amount of the Canadian Wheat Board (CWB) net initial payment on the crop involved.

The "Baseline" data was calculated from, and represents the actual production which occurred while the "MOP" (Method of Payment) data represents the estimated production after a change to a producer payment.

The production of each crop in each region was estimated under both payment schemes. The crop production changes and an estimate of the acreage change based on historical yields follows. In order to give the reader a factor upon which to compare the magnitude of the change in production and acreage, previous changes which actually occurred in both production and acreage in each region is presented. Tables and graphs of the changes in acreage for each region in Alberta are presented in Appendix E.

Note the years reported in the tables refer to crop years, e.g., 1988 refers to the 1987-1988 crop year.

1. Region 1.

a. Wheat

Estimated production changes from baseline to MOP

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Unchanged	-	-	0
1979	Increase	1292	35.1	6.1
1980	Increase	4144	112.8	19.6
1981*	Decrease	7735	210.5	24.0
1982*	Decrease	3167	86.2	9.8
1983	Increase	7873	214.2	26.4
1984*	Decrease	7444	202.5	32.6
1985	Increase	7702	209.6	40.4
1986*	Decrease	2802	76.2	8.8
1987*	Decrease	1592	43.3	4.2
1988	Increase	5372	146.2	15.0

The response in wheat production after a change to a producer payment varied with increases in production in five years and decreases in five years. Over all eleven years a net increase of 102,200T is predicted. At yield of 0.9T/acre or 32 bushels**, a net increase of 111,000 acres

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* Caution should be taken in interpreting these results. Barley acres did appear to influence wheat production but the variance in barley production was low causing econometric problems for developing this region's barley supply function.

** Yields are actual yields as reported in the Agriculture Statistics year book, published by Alberta Agriculture 1986, 1987 and 1988.

would be required to give this increase in production. Excluding the drought years of 1984 and 1985, actual wheat acreage changes from year to year in this region have only once equalled the estimated magnitude of change which was between 1982 and 1983 when wheat acres increased 127,000 acres. In the past ten years there has not been a change in wheat acreage sufficient to equal the 238,000 acre increase necessary to produce the largest increase in production (214,000T) expected from a change to a producer method of payment.

In 1987, 1,460,000 acres were seeded into wheat (all wheat) in the region and 1,255,000 acres were fallowed. Actual wheat and barley acres used in the analysis represents all wheat and barley acreage. Appendix D illustrates actual spring wheat and feed barley acreages. If the increase in wheat production were to come from reducing fallow acres, a 19% reduction in fallow to 1,017,000 acres, would be required.

The formulas developed to estimate wheat production in this region suggest that year to year changes in wheat production were mainly in response to the acres fallowed in the previous year.

It was a concern of the researchers that a relationship between wheat production and wheat price was not found in this region. In that the acres seeded to wheat increased gradually over the years, the response to wheat price may be inherent in the base or constant level of wheat production in the region.

b. Barley

Estimated production changes from baseline to MOP.

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Increase	189	4.1	4.5
1979	Increase	111	2.4	2.7
1980	Increase	123	2.7	3.2
1981	Increase	444	9.7	12.8
1982	Increase	505	10.9	9.8
1983	Increase	88	1.9	4.1
1984	Increase	499	10.8	21.4
1985	Increase	83	1.8	3.9
1986	Increase	175	3.8	3.4
1987	Increase	620	13.5	11.1
1988	Increase	134	2.9	4.2

Barley production increased in all years as a result of a change to a producer method of payment. The average increase was 5.8 thousand tonnes. The largest increase in the production of barley in the region was 13.5 thousand tonnes in 1987. At 50 bushels per acre yield, the average of the past three years, 12,200 additional barley acres would need to be seeded to produce this volume. Changes in the acres seeded to barley equivalent or greater than 12,000 acres have occurred several times in this region, the greatest change being an increase of approximately 29,000 acres between the 1980 and 1981, and the 1985 and 1986 crop years.

In 1987, 95,000 acres of barley were seeded in the region yielding 69,400T of barley. The estimated increases of 2,000 to 13,000T appears feasible.

c Canola

Estimated production changes from baseline to a producer method of payment

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Increase	75	1.7	44.9
1979	Increase	94	2.1	35.5
1980	Increase	107	2.4	46.7
1981	Increase	110	2.5	79.0
1982	Increase	125	2.8	120.8
1983	Increase	121	2.7	59.0
1984	Increase	127	2.9	39.0
1985	Increase	114	2.6	26.1
1986	Increase	143	3.2	24.5
1987	Increase	162	3.7	18.5
1988	Increase	157	3.5	14.2

An increase in canola production is estimated in all years. The largest increase was 3.7 thousand tonnes in 1987. In order to attain this increase an additional 5,789 acres would need to be seeded to canola assuming yields would equal the 28 bu/ac or 0.63T average of the past three years. Actual production in this region in 1988 was 25,000T from 32,000 acres seeded into canola. An increase of 3,000T at the average yield (28 bu) would require an additional 4,700 acres.

Canola production in this region appears to be most directly influenced by wheat prices. As wheat prices increase canola production drops and vice versa. A trend towards increased production was also apparent in canola in this region.

Summary of Region 1.

It is estimated that a change in the production of the various crops would have occurred in this region in response to a change in the method of payment. Wheat production would change the most in actual amounts, 102,000 while the canola would undergo the greatest proportional change with a 45% increase on average. The change in wheat production varied from year to year showing both increases and decreases. Barley and canola production would have increased in every year. In this region there is 1 - 1.3 million acres of fallow. An area of 220,000 acres would be required to yield the estimated increase in production during the years with the largest change.

Wheat production in this region appears to be relatively independent of barley and canola production. The exceptional adaptability of wheat to the dryland conditions prevalent in this region may explain this situation. Barley and canola production do appear to compete for the same acreage as the production of each is dependent on some aspect of the production of the other crop. Canola and barley compete for irrigated acres.

Sensitivity analysis was performed on the estimated coefficients in the model to determine the possible range in production following a method of payment change. Wheat production in Region 1 was found to be sensitive to changes in the grain transportation (subsidy) variable. The results indicate wheat production decreasing when compared to the method of payment results, by approximately 12.5%. Decreasing the price coefficients by 5% shows a decline in wheat production in Region 1 by approximately 9%. Wheat production in this region was found not to be sensitive to the lagged barley acreage coefficient. This decrease in wheat production resulted from a 5-6% decline in lagged barley production. The results of the sensitivity analysis are reported in Appendix D.

Barley and canola production was found not to be sensitive to changes in the price and subsidy coefficients in this region.

2. Region 2.

a. Wheat

Estimated changes in the production of wheat from baseline to producer producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Increase	1451	39.5	3.4
1979	Increase	1754	47.7	3.8
1980	Increase	2022	55.0	3.6
1981	Increase	2029	55.2	3.4
1982	Increase	2494	67.8	3.4
1983	Increase	2233	60.7	4.3
1984	Increase	2172	59.1	5.1
1985	Increase	2042	55.5	4.5
1986	Increase	2405	65.4	3.5
1987	Increase	2874	78.2	3.3
1988	Increase	2779	75.6	3.6

It is estimated that wheat production would increase in Region 2 in response to a change to a producer method of payment. The increases in production varied from 39,500T to 75,600T with an average change of 60,000T. At the average yield of the previous three years, 36 bu/ac or 1T/acre, an additional 60,000 acres would need to be seeded into wheat in order to increase production by 60,000T.

Over the 11 years studied, changes in the acreage seeded to wheat have equalled or surpassed the 60,000 acres at four times. Between 1985 and 1986 acreage increased 66,000 acres. Between 1982 and 1983 acreage increased 213,000 acres and an increase in acreage of the same magnitude occurred between 1980 and 1981.

Summerfallow acres in this region have varied 10,000 - 30,000 acres periodically and a substantial decline of 100 000 acres occurred from the 1982 to 1983 crop years. In 1987, 1,494,000 acres were fallowed and 2,230,000 acres seeded to wheat, 1,050,000 to spring wheat.

Production of wheat in this region responded primarily to the previous year's summerfallow acreage and to a lesser extent, the expected canola price.

b. Barley

Estimated changes in the production of barley from the baseline to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Decrease	342	7.0	0.9
1979	Decrease	414	9.0	1.3
1980	Decrease	477	10.4	1.3
1981	Decrease	491	10.7	0.9
1982	Decrease	589	12.8	1.3
1983	Decrease	527	11.5	1.6
1984	Decrease	512	11.1	2.6
1985	Decrease	482	10.5	1.5
1986	Decrease	567	12.3	1.3
1987	Decrease	678	14.7	1.4
1988	Decrease	656	14.3	1.3

It is estimated that barley production would have decreased in Region 2 following a change to a producer method of payment. This decrease will range from 14.7 thousand tonnes to 7,000 tonnes with an average decrease of 11.3 thousand tonnes. At the average yield of the previous three years, 60 bu or 1.3T/acre, an 11.3 thousand tonne decrease would take a reduction of 8.7 thousand acres. Excluding 1985 because of the drought, production and barley acreage changes equivalent or greater to the above noted change have occurred in three of the past ten years. Between 1983

and 1984 farmers in this region reduced their barley acres by 121,000 acres and production dropped over 200,000 tonnes. A decrease of the same magnitude occurred from 1981 to 1982. Decreases in seeded acres greater than 10,000 acres have occurred five times since 1978. Barley production in this region is mainly influenced by barley prices and an apparent upward trend. Over the years yields have increased from 1T/ac to 1.4T/ac. Barley production also responds inversely to canola prices. Barley and canola compete for the same irrigated land resource in Region 2, which following a producer method of payment change would cause an increase in the higher value crop (canola) and a decrease in a lower value crop (barley).

In 1987 farmers in this region seeded 739,000 acres into barley and produced 1,040,000T of barley.

c. Canola

Estimated changes in the production of canola from baseline to a producer method of payment are as follows.

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Increase	633	14.3	10.0
1979	Increase	748	16.9	10.9
1980	Increase	1333	30.2	20.8
1981	Increase	1426	32.3	27.8
1982	Increase	1622	36.8	32.9
1983	Increase	1615	36.6	37.1
1984	Increase	1522	34.5	34.5
1985	Increase	871	19.7	19.7
1986	Increase	1328	30.1	26.1
1987	Increase	636	14.4	8.4
1988	Increase	1407	31.9	17.5

It is estimated that canola production would have increased in all years in response to a change to a producer method of payment. Production increases ranged from 14.3 thousand tonnes to 36.8 thousand tonnes, with an average of 27.1 thousand tonnes.

In order to increase production to 36.8 thousand tonnes 60,000 additional acres of canola would need to be seeded if yields equivalent to the average of the past three years, .6T or 27 bushels, per acre were attained.

Past records show year to year increases in canola acres of 95,000, 118,000 and 133,000 acres over the past eleven years.

In 1987, 546,000 acres were seeded to canola in this region. In that year 1.4 million acres were fallowed in the region. The 54,000 acre increase in seeded acres amounts to only a 10% increase in the 1987 acreage, or a 4% reduction in fallow acres.

Canola production in this region appears to be most influenced by a change in the price of wheat. As the wheat price increases canola decreases and vice versa.

Summary of Region 2.

It is estimated that changes in production would have occurred with all crops in Region 1 in response to a change to a pay the producer method of payment. Wheat and canola production would have increased while barley production would decrease. At the extreme, wheat and canola acreage would increase 78,000 and 52,000 acres respectively; barley acreage would reduce some 10,500 acres. The net increase in seeded acres, given yields equivalent to the past three years, would equal 119.5 thousand acres. With 1.4 million acres in fallow an increase in seeded acres of this magnitude is feasible.

Wheat production in Region 2 appears to be independent of the production of barley or canola. Barley and canola do, however, appear to compete for

the scarce acres. In that barley and canola are often produced under irrigation in this region, the potential for competition appears evident. A 5% decline in the transportation subsidy and grain prices displayed a less than 5% change in the production of the various crops.

3. Region 3.

a Wheat

Estimated changes in the production of wheat in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Increase	694	18.9	6.7
1979	Increase	429	11.7	3.3
1980	Increase	1472	40.0	9.0
1981	Increase	1578	42.9	12.1
1982	Increase	609	16.6	2.5
1983	Increase	1789	48.7	9.9
1984	Increase	480	13.1	3.5
1985	Increase	1777	48.3	18.6
1986	Increase	590	16.0	2.2
1987	Increase	2160	58.8	7.6
1988	Increase	528	14.4	2.4

It is estimated that the production of wheat would have increased in response to a change to a producer method of payment.

Production changes range from a low of 11.7 thousand tonnes to 58.8 thousand tonnes. At the average yield of the past three years .92T/acre or 33 bu/acre, the acres needed to give this increase in production would be 12,700 acres to produce 11,700T and 64,600 acres to produce 58,800T.

Historically, increases in the acres seeded to wheat in the magnitude of 50,000 - 100,000 acres have occurred four times since 1978. In 1987 547,000 acres were seeded into wheat (Spring and Durum) in this region producing 777,000T of wheat. Fallow acres in 1987 were 248,000 acres.

From the analysis conducted it appears that wheat and barley compete for acreage in this region. As the barley price increases, barley production increases and wheat production decreases. The reverse occurs when barley prices fall.

b. Barley

Estimated changes in barley production in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Decrease	589	12.8	1.3
1979	Decrease	14 921	325.0	41.0
1980	Increase	13 674	296.1	27.8
1981	Increase	10 466	227.8	18.3
1982	Increase	2 351	51.2	3.8
1983	Increase	32 119	699.1	90.3
1984	Increase	46 852	1 020.2	224.0
1985	Increase	34 950	760.0	156.0
1986	Decrease	20 897	454.8	33.6
1987	Increase	15 808	344	30.5
1988	Decrease	14 385	313	27.0

Exceptionally large changes in barley production were predicted in this region, as high as 1 million tonnes. The response pattern is mixed with seven years showing an increase in production and four years a decrease. The magnitude of the increases averaged 340,000T while the years of decreased production averaged 276,000T. At an average yield of 1.3T/acre, 60 bu/acre (the average of the past three years), an increase in production of 340,000T would require an additional 260,000 acres. Over the time period studied the greatest increase in production occurred from 1979 to 1980 when 240,000T of additional production was realized in conjunction with an 80,000 acre increase in the area seeded to barley. Fallow in this region was 248,000 acres in 1987. It would appear that the additional acres would have to come from a reduction in fallow. The average of the estimated decreases in production, 276,000T, at an average yield of 1.3T/acre would call for 212,000 acres being taken out of barley production. During years in which the barley acreage decreased in this region, barley acreage reductions varied from 150,000 to 350,000 acres. The largest decline was between 1983 and 1984 when the area seeded to barley reduced 350,000 acres.

Barley production in this region appears to vary in response to the barley price directly and inversely to the price of canola.

c. Canola

Estimated changes in the production of canola from a change to a producer method of payment as follows:

Year	Direction	Change from Actual Production Thousand Bushels	Thousand Tonnes	% Change
1078	Increase	501	11.4	8.6
1979	Increase	992	22.5	17.9
1980	Increase	281	6.4	5.9
1981	Increase	1259	28.5	46.2
1982	Increase	973	22.1	26.9
1983	Increase	1441	32.7	39.6
1984	Increase	1359	30.8	46.1
1985	Increase	1422	32.2	66.1
1986	Increase	1042	23.6	25.9
1987	Increase	1389	31.5	30.2
1988	Increase	1124	25.5	21.6

It is estimated that canola production would have increased in this region in response to a change to a producer method of payment. The largest increase estimated was 32.7 thousand tonnes, the smallest 6.4 thousand tonnes. The average increase over the eleven years was 24.3 thousand tonnes.

Given the average yield with canola in this region over the past three years, 0.6T or 26 bu. a 40,500 acre increase in seeded acres would be needed to produce the additional 24,000T of canola production estimated.

Previous production patterns have shown increases in canola production between consecutive years of 10,000T or more in four out of the past ten years. The largest increase was between 1986 and 1987 when an additional 30,000 acres of canola were seeded, increasing production by 20,000T. In 1987 farmers in this region seeded 180,400 acres into canola and produced 110,000T of seed.

From the analysis it appears that the main factor affecting canola production in this region is an overall trend towards higher production and the price of wheat. As the wheat price increases canola production declines.

Summary of Region 3.

A change to a producer method of payment had a tendency to cause an increase in production of all crops in this region. Barley production appears to be an exception in certain years when substantial reductions would occur.

The additional acreage needed to reach the maximum levels of production in barley would result in a severe reduction in fallow acres. A change towards the largest increases in barley may not have occurred depending on limitations farmers face when seeding. The estimated changes in the production of wheat and canola are well within the range of past production patterns. It does appear from the analysis that all three crops compete for the available acres. This would mean that production

responds not only from change in the price of the specific crop, but also from relative changes in the price of the competing crops.

A Sensitivity Analysis on the grain transportation subsidy variable (5% decline) in this region shows approximately a 12.5% decrease in both wheat and barley production. Wheat and barley production appear not to be sensitive to changes in the price coefficients.

4. Region 4.

a. <u>Wheat</u>

Estimated changes in the production of wheat in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1989	Decrease	3192	86.8	9.6
1979	Decrease	7051	191.9	16.9
1980	Decrease	3713	101.0	6.9
1981	Decrease	4171	113.5	7.7
1982	Decrease	9699	263.9	16.7
1983	Decrease	3391	92.3	5.8
1984	Decrease	8337	226.8	15.2
1985	Decrease	4645	126.4	8.7
1986	Decrease	3617	98.5	8.7
1987	Decrease	5985	162.8	9.4
1988	Decrease	6996	190.4	15.5

It is estimated that wheat production would have decreased in Region 4 after a change to a producer method of payment. Decreases in production would range from 86,000T to 264,000T with an average decrease of 158,000T. At the average yield of the past three years of 1.0T/acre, 158,000 acres would be directed from wheat production.

A review of past production patterns shows that excluding 1985 there were two years in the past eleven when wheat acreage dropped in the magnitude of 120,000 acres. Between 1986 and 1987 wheat acreage reduced 176,000 acres and between 1983 and 1984 wheat acreage dropped 142,000 acres.

In 1987 the production of wheat in region 4 was 1,167,000T from 1,679,000 acres.

The analysis of wheat production in this region found that wheat production and the price of wheat increased and decreased in unison. Wheat production responded inversely to the price of canola.

b. Barley

Estimated changes in the production of barley in Region 4 in response to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Decrease	327	7.2	0.9
1979	Decrease	593	12.9	1.6
1980	Decrease	232	5.0	0.4
1981	Decrease	208	4.5	0.4
1982	Decrease	866	18.8	1.6
1983	Decrease	178	3.9	0.5
1984	Decrease	840	18.3	2.0
1985	Decrease	188	4.1	0.4
1986	Decrease	714	15.5	1.1
1987	Decrease	344	7.5	0.5
1988	Decrease	624	13.6	1.1

It is estimated that barley production would have decreased in Region 4 in response to a change to a producer method of payment. The reduction in barley production is estimated to vary from a decrease of 4,100T to 18,800T with an average decline of 10,000T.

Over the past three years the average yield of barley has been 1.3T/acre. At this yield barley acreage would have needed to have been reduced 7,800 acres to allow for the average annual decrease in production. Year to

year reductions in the barley acres equal to or greater than 10,000 acres have occurred often, four times in the last eleven years. The greatest reduction in acreage occurred from 1983 to 1984 when the barley acreage in this region decreased 140,000 acres.

The analysis of the barley production pattern in this region found that barley production responded directly to changes in the price of barley, and inversely to the price of canola.

In 1987, 946,000 acres of barley (Feed and Malt) were seeded producing 1,238,000T of barley.

c. Canola

Estimated changes in canola production in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Increase	2573	58.3	18.7
1979	Increase	3158	71.6	17.7
1980	Increase	3677	83.4	22.1
1981	Increase	3787	85.9	40.7
1982	Increase	4592	104.1	32.8
1983	Increase	4084	92.6	24.6
1984	Increase	4216	95.6	19.9
1985	Increase	3943	89.4	21.3
1986	Increase	4931	111.8	22.9
1987	Increase	5588	126.7	19.5
1988	Increase	5400	122.5	20.9

It is estimated that production of canola would have increased in response to a change to a producer method of payment. The magnitude of the increases vary from 58.3 to 126.7 thousand tonnes with an average production change of 94,720T. At the average yield of the past three years, 568 kg or 25 bu/acre, canola acres would increase by 166,760 acres. In the year with the largest estimated increase 1987 with 126,000T, an increase of 221,800 acres would be required to produce the additional canola.

Reviewing actual production patterns over the past eleven years, it was noted that increases of 100,000 acres occurred between 1983 and 1984, and between 1982 and 1983 canola acres increased 236,000 acres.

In 1987, 1,303,000 acres of canola were seeded in Region 4 producing 337,000T of canola. Canola production in this region appears to be mainly influenced by summerfallow acres of the previous year and the price of barley. This is an inverse relationship, with canola production reducing as fallow acres and/or the barley price increase.

Summary of Region 4.

The analysis conducted suggest that a change in the method of payment would have resulted in large decreases in the production of wheat (7 - 16%) and large increases in the production of canola (17 - 30%). A moderate decrease in barley production was also estimated. In aggregate, seeded acres would, on average, increase 30,000 acres. In that this region has approximately 1 million acres in fallow, these additional acres may be achieved by a reduction in the fallow acreage.

It appears from the analysis that all crops compete for the available acres. This would mean that not only the price of the crop itself will affect production levels, but also the price of the other two competing crops.

Sensitivity Analysis on the grain transportation variable (5% decline) show barley and canola production declined by 3.9% and 1.9% respectively. Wheat production in Region 4 would increase by 1.9%, the result of lagged barley acreage being inversely related to current wheat production. Decreases (5%) in the price coefficients in Region 4 results in a 4% decline in wheat production, while barley and canola production decrease by 0.7% and 3.7% respectively.

5. Region 5.

a. <u>Wheat</u>

Estimated changes in the production of wheat in Region 5 in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Decrease	736	20.0	17.2
1979	Decrease	2647	72.0	55.8
1980	Decrease	3378	91.9	49.7
1981	Decrease	2408	65.5	31.7
1982	Decrease	4137	112.6	48.2
1983	Decrease	5751	156.5	77.1
1984	Decrease	3740	101.8	44.8
1985	Decrease	2325	65.3	26.4
1986	Decrease	3939	107.2	38.1
1987	Decrease	2048	55.7	22.9
1988	Decrease	4085	110.9	58.8

It is estimated that a decrease in wheat production would have occurred in response to a change to a producer method of payment in Region 5. Estimates of the decreases in production vary from 20 to 156 thousand tonnes with an average decrease of 87 thousand tonnes.

At the average yield of the past three years, 44 bu or 1.2T per acre, a production decrease of 87,000T would be associated with a reduction of 72,500 acres. A decrease in wheat acres of this magnitude has not occurred over the past eleven years. The greatest decrease in wheat acres occurred between 1987 and 1988 when the acres seeded to wheat decreased 36,000 acres. This reduction was associated with a 70,000T decrease in wheat production. The next largest decrease was between 1984 and 1985 when wheat acres reduced by 26,000 acres and production decreased by 40,000T.

The production of wheat in this region was 184,000T in 1987 from 240,000 acres seeded to wheat. Wheat production changes in this region are mainly in response to the price of wheat in a direct relationship and inversely with the price of canola.

b. Barley

Estimated changes in the production of barley in Region 5 in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Decrease	1236	26.9	2.2
1979	Decrease	2117	46.1	3.8
1980	Decrease	894	19.5	2.0
1981	Decrease	2644	57.5	3.7
1982	Decrease	3008	65.5	4.4
1983	Decrease	2214	48.2	4.0
1984	Decrease	2811	61.2	4.8
1985	Decrease	2681	58.3	4.3
1986	Decrease	1126	24.5	1.6
1987	Decrease	3516	76.5	4.8
1988	Decrease	3595	78.2	4.9

It is estimated that the production of barley would have decreased in Region 5 in response to a change to a producer method of payment. The estimated decreases in production vary from 19.5 to 78.2 thousand tonnes with an average decline of 51.1 thousand tonnes.

At a yield of 60 bu or 1.3T per acre, barley acres would need to decline 39,300 acres to equal the 51.1 thousand tonnes decrease in production. Decreases in the production and acreage of barley equivalent to 39,000

acres and 51,000T occurred three times in the last eleven years. From 1982 to 1983 barley acres decreased 140,000 acres and the 1983 crop yielded 143,000T less than was produced in 1982. Between 1981 and 1982 production of barley decreased 100,000T associated with a 32,000 acre decline.

In 1987, 1,348,000 acres were seeded to barley with a production of 1,545,000T. The analysis of barley production patterns in this region show that barley production responds directly to changes in the price of barley and inversely to changes in the price of wheat and stocks of barley on hand.

c. <u>Canola</u>

Canola production in region 5 was found to be relatively independent of the price of canola or other crops over the time period studied. Rainfall amounts and stocks of canola and barley seem to play the major roles in determining canola production. Because rainfall, barley and canola stocks were the only factors which had a significant relationship with canola production, the analysis was unable to detect any change in canola production in response to a change to a pay the producer method of payment.

d. <u>Oats</u>

Estimated changes in the production of oats in Region 5 in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Increase	251	3.8	1.4
1979	Decrease	234	3.6	1.4
1980	Increase	929	14.3	5.8
1981	Decrease	447	6.9	2.6
1982	Increase	451	6.9	2.6
1983	Decrease	107	1.6	0.7
1984	Increase	1643	25.3	10.6
1985	Increase	83	1.3	0.5
1986	Increase	949	14.6	4.6
1987	Decrease	134	2.1	0.7
1988	Increase	6579	101.4	38.0

The above estimates suggest that oat production in Region 5 would increase in seven years and decrease in four years out of the past eleven years. The magnitude of the increases vary from an exceptional 101,400T in 1988 to 1,300 tonnes. The average increase excluding the abnormal change in 1988 was 11.0 thousand tonnes; including the change in 1988 the average increase becomes 16.5 thousand tonnes.

The increase in area required to produce this additional production at yield levels of 80 bu or 1.2T per acre would equal 9,000 acres.

Increases in oat acreage of 25,000 acres and 65,000 acres occurred between 1985 and 1986 and 1980 and 1981 respectively. In order to meet the large 101,400T increase estimated in 1988, an increase in the area seeded to oats of 82,000 acres would be necessary.

The average change of the four years in which production decreased was 3,500T. At the production levels noted above, the area seeded to oats would decrease by 2,800 acres. Decreases in production in the past would readily account for the 2,800 acre decrease.

In 1987, 240,000 acres were seeded to oats and produced 286,000T of seed. Oat production in this region appears to respond directly with the area seeded to oats the previous year and inversely with the price of canola.

Summary of Region 5.

The analysis suggests that wheat and barley production would have decreased in response to a change to a producer method of payment. Canola would have been unaffected and oats would have had a mixed response but overall toward an increase in production. The magnitude of the reduction in wheat acres is extreme at more than 70,000 acres on average. A reduction in wheat production, in response to reduced acres seeded to wheat, of this magnitude has not occurred in the past eleven years.

The changes in the production of oats and barley are well within historical patterns.

It is apparent from the analysis that wheat, barley and oats all compete for the same acres within this region. Canola production may be an exception, but the lack of any direct response to a change to a producer method of payment prevented the researchers from determining the relationship of canola to the other three crops.

Sensitivity analysis of the Grain Transportation variable and the price coefficients show that a 5% change in these variables resulted in a response of less than 5% in production levels.

6. Region 6.

a. Wheat

Estimated changes in the production of wheat in Region 6 in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1979	Decrease	788	21.4	13.8
1980	Decrease	1452	39.5	19.3
1981	Decrease	1562	42.5	25.3
1982	Decrease	1769	48.1	22.6
1983	Decrease	1780	48.4	19.1
1984	Decrease	1724	46.9	23.7
1985	Decrease	1684	45.8	26.4
1986	Decrease	1875	51.0	26.3
1987	Decrease	2192	59.6	40.8
1988	Decrease	2256	61.4	36.8

These estimates suggest that wheat production would have decreased in Region 6 in response to a change to a pay the producer payment.

The largest decrease is estimated at 2,256,000 bu or 61,388T in 1988. Considering the average yield for wheat in this region over the past three years, 36 bu or 1.01T/acre, the area seeded to wheat would need to decrease 61,400 acres in order to equal this reduction in production. The average estimated decrease was 1,810,000 bu or 49,200T. To meet this reduction in yield a decrease of 49,252 acres would have been required.

Reviewing the past production patterns of this region it is apparent that a decrease of wheat acreage and production in the magnitude of the estimated reduction reported above has only occurred once in the past eleven years. From 1983 to 1984 wheat acreage in this region reduced 66,000 acres and a corresponding decrease in production of 61,000T occurred. The second largest decrease in wheat production occurred between 1986 and 1987 when 24,000 acres were removed and production decreased 28,000T.

In 1987 the production of wheat in this region was 13,400T or 4,924,000 bu from an acreage of 195,000 acres. The estimated reduction of 61,000T in this year would be a significant reduction in wheat production in the region.

The production of wheat in Region 6 responds directly to the price of wheat and the price of canola but inversely to the acres of barley seeded in the region.

b. Barley

Estimates of the change in barley production in Region 6 from a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Decrease	1119	24.3	4.9
1979	Decrease	1938	42.2	8.5
1980	Decrease	2272	49.4	8.6
1981	Decrease	797	17.3	2.2
1982	Decrease	1102	23.9	2.7
1983	Decrease	2741	59.7	8.5
1984	Decrease	2678	58.3	7.5
1985	Decrease	755	16.4	1.9
1986	Decrease	1715	37.3	4.2
1987	Decrease	1269	27.6	2.7
1988	Decrease	3492	76.0	9.3

It is estimated that barley production would have decreased in every year in Region 6 in response to a change to a producer method of payment. The largest decrease was 3,492,000 bu or 76,012T in 1988, the smallest 797,000 bu or 17,300T in 1981. The average decrease over the ten years was 39,300T.

The average yield of barley in this region over the past three years is 55 bu or 1.2T/acre. At this yield, barley acres would need to be reduced

32,750 acres in order to meet the 39,300T reduction in production. Changes in the production of barley have been frequent and often large. Between 1982 and 1983 the area seeded to barley in this region decreased 100,000 acres and barley production in turn decreased 9,054,000 bu or 197,000T. From 1987 to 1988 a decrease in barley acres and production of a slightly less magnitude than the 1982-1983 situation occurred with a drop in production of 171,000T from a decrease of 141,000 acres.

It would seem reasonable that barley in this region would decrease given that producers are located the greatest distance from a barley market.

The production of barley in this region in 1987 amounted to 870,000T from 776,000 acres. Barley production responds mainly to changes in the price of barley but also in an inverse manner to changes in the canola price.

c. Canola

Estimates of the change in canola production in Region 6 in response to a change to a producer method of payment are as follows:

Year	Direction	Change from Actual Production Thousand Bushels	Thousand Tonnes	% Change
1980	Decrease	609	13.8	16.8
1981	Decrease	381	8.6	40.2
1982	Increase	593	13.4	42.0
1983	Increase	661	15.0	31.9
1984	Increase	663	15.0	24.3
1985	Decrease	340	7.7	5.7
1986	Decrease	840	19.0	11.1
1987	Decrease	430	9.7	5.6
1988	Increase	889	20.2	12.3

The analysis shows that changes in canola production in Region 6 would be mixed with both increases and decreases occurring in response to a change to a producer method of paymnt. Over the past nine years there would have been four years in which canola production would increase and five years in which it would decrease with a change to a producer method of payment.

The four years in which production increased show an average increase of 15,900T. The average reduction over the five years in which decreases occurred was 11,800T . Past records for this region show a three year average canola yield of 23 bu or 0.5T acre. At this yield 30,500

additional acres of canola would need to be planted in order to meet the 15,900T increase in production and 22,600 acres would need to be diverted from canola production if production were to drop the estimated 11,800T.

Changes in canola production in the magnitude of those estimated have occurred in this region over the past nine years. Between 1983 and 1984 canola production in this region increased 50,000T in response to a 58,000 acre increase in the area seeded to canola. From 1982 to 1983 canola acres increased 60,000 acres and production in turn increased 17,000T.

Past production decreases have been few. From 1980 to 1981 canola production decreased 40,000T from an acreage decrease of 90,000 acres. A 25,000T decrease in canola production occurred between 1979 and 1980, the corresponding acreage reduction was 150,000 acres.

In 1987 the 129,500T or 5,700 000 bu of canola were produced in this region from 232,000 acres. A change of 20-30 thousand acres seeded into canola would be a 10-15% change from the actual.

Canola production in this region is mainly related to an overall trend towards increased production and the previous year's canola acreage. In that disease problems have led farmers to a two or three year rotation with canola, the restriction based on the previous year's production is reasonable.

Summary of Region 6.

It is estimated that with a change in the method of payment wheat and barley production would have decreased in this region. The estimated reduction in both crops is extensive averaging close to two million bushels. Canola production displayed a mixed response from a change to a pay the producer method of payment, with a net change over the ten years of a 5,000T increase in production. Canola production over these years is estimated to increase as much as 890,000 bu in some years and decrease by 600,000 bushels in other years in response to a producer method of payment.

The analysis suggests that the crops in this region compete for the same acreage. Wheat and barley both respond to changes in the canola price. Wheat production increases as canola price increases, while barley production decreases. It was also found that wheat prices directly influenced the production of wheat, with barley prices directly influencing barley production.

It was found that grain production in this region was not sensitive to changes in the price and grain transportation subsidy coefficients.

7. Region 7.

a. Wheat

Estimates of the change in wheat production in Region 7 from a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Decrease	905	24.6	2.5
1979	Decrease	1625	44.2	6.0
1980	Decrease	607	16.5	0.9
1981	Decrease	2027	55.2	47.4
1982	Decrease	778	21.2	7.3
1983	Decrease	470	12.7	0.3
1984	Decrease	2073	56.4	11.9
1985	Decrease	375	10.2	1.5
1986	Decrease	1445	39.3	5.6
1987	Decrease	2385	64.9	3.6
1988	Decrease	2217	60.3	3.2

The analysis suggests that the production of wheat in Region 7 would reduce after a change to a producer method of payment.

The average decrease over the eleven year period was 36.8 thousand tonnes or 1,355,000 bushels. At the three year average yield for wheat in this region 30 bu or 816 kg per acre, the area seeded into wheat would have had to reduce by 45,233 acres to realize the 36.8 thousand tonne reduction.

Past production records of this region show decreases in wheat production of 240,000 bu or 65,300T from 1983 to 1984. This decrease in production was accompanied by a 93,000 acre reduction in the area seeded to wheat. In all other years the area seeded to wheat increased although reductions in production have occurred due to factors other than the seeded acreage.

In 1987, 26 million bushels of wheat were produced on 793,000 acres in this region. The analysis found that wheat production in this area is mainly influenced by canola prices and the previous year's summerfallow acreage.

b. Barley

Estimated changes in the production of barley in Region 7 in response to a change to a producer method of payment are as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1978	Decrease	517	11.3	1.6
1979	Decrease	722	15.8	2.2
1980	Decrease	834	18.3	2.5
1981	Decrease	871	19.1	2.4
1982	Decrease	1019	22.3	2.5
1983	Decrease	956	20.9	2.7
1984	Decrease	856	18.7	2.5
1985	Decrease	766	16.8	2.7
1986	Decrease	910	19.9	2.1
1987	Decrease	1045	22.9	2.7
1988	Decrease	1035	22.7	2.6

This analysis suggests that barley production would have decreased in Region 7 in response to a change in the method of payment. The reductions vary from 11,300T to 22,900T with an average reduction of 18,900T. Barley yields in this region over the past three years has averaged 45 bu or 1T/acre. At this yield the area seeded to barley would need to reduce 19,044 acres in order to reduce production by the estimated 18,900T. The largest reduction 22,700T would require a reduction of 23,200 acres.

Past production patterns in this region have displayed declines in acreage and production greater than the estimated reduction in two years over the last eleven. Between 1986 and 1987 the area seeded to barley in this region decreased by 35,000 acres and production decreased 20,000T. A very large 80,000T reduction in barley production occurred from 1982 to 1983 along with a 30,000 acre decrease in barley acreage.

In 1987, 1,004,000 acres were seeded to barley yielding 38 million bushels or 829,000T. Over the years, barley production in this region is mainly influenced by the price of barley and the price of canola. Barley production increases as the barley price increases and production falls as the canola price increases.

c. Canola

An analysis of the effect a change to a pay the producer method of payment would have on canola production in Region 7 is as follows:

Year	Change from Actual Production			
	Direction	Thousand Bushels	Thousand Tonnes	% Change
1979	Increase	2957	67.1	17.8
1980	Increase	3399	77.1	20.5
1981	Increase	3493	79.2	40.2
1982	Increase	4180	94.8	42.0
1983	Increase	3748	85.0	31.8
1984	Increase	3356	76.1	24.3
1985	Increase	3003	68.1	27.6
1986	Increase	3753	85.1	31.4
1987	Increase	4253	96.5	23.1
1988	Increase	4110	93.2	22.5

Increases in canola production were estimated to occur in Region 7 in response to a change in the method of payment. Canola production increases ranged from 67-96 thousand tonnes with an average change of 82.2 thousand tonnes or 3.6 million bushels. The average yield of canola in this region over the past three years was 21 bu or 480 kg per acre. An additional 172 600 acres would need to be seeded to canola in order to produce the estimated increase in production. The largest change was 96,460T or 4.1 million bushels; at average yields an additional 202,000

acres would need to be seeded to canola in order to meet this estimated increase in production. Year to year changes in canola production over the past ten years has not been in the magnitude of the estimated change. A change of this magnitude, 175-200 thousand acres, has only occurred over a three to four year period. The largest year to year increase occurred between 1982 and 1983 when canola acreage increased by 148,000 acres with a change in production of 57,000T. Other increases have been 90,000 acres between 1985 and 1986 and a 40,000 acre increase from 1986 to 1987.

Considering the estimated reductions in wheat and barley of approximately 65,000 acres coupled with 500,000 to 700,000 fallow acres, an acreage limitation is not apparent. It is noteworthy that with disease and insect problems canola rotations could limit the response to something less than the estimated change.

In 1987, 400,000T or 18 million bushels of canola was produced from 777,200 acres. The production of canola in this region appears to be primarily related to the price of barley in an inverse manner and directly with an overall trend toward increased production.

Summary of Region 7.

The analysis found that wheat and barley production would have declined in this region after a change to a pay the producer method of payment, and canola production would have increased. The magnitude of the decrease is

notably large with wheat production averaging a 2.3 million bushel decline and barley decreasing by 860,000 bu. Such decreases have occurred in the past in response to a decrease in seeded acres in the two crops, but only once in the past eleven years have wheat acres changed by an amount equivalent to the change expected in response to a change to a producer method of payment.

Canola acres show a sizeable increase in response to a change in the MOP, 3.6 million bushels on average. Crop rotation procedures employed by farmers may, however, limit the degree to which farmers make this adjustment.

The price of barley and canola appear to be the most influential prices affecting the production of these three crops in this region. Barley prices influenced canola and barley production, and canola prices influenced barley and wheat production. The relationship between wheat and fallow acres is not unexpected as fallow in this region as in Regions 1 and 2 is most often seeded to wheat. These relationships would suggest that all crops compete for the limited acreage so the prices of alternate crops will influence which crop is grown. Wheat may be an exception to this in view of its relationship to the summerfallow acres.

8. Summary of Crop Production Responses

The analysis of crop production through the application of the simulation model suggests that crop production would change in all regions in response to a reduction in the price of grain resulting from a change to a producer method of payment. Wheat production would have increased in southern Alberta but decreased in all other regions. Dunlop (1989) estimates a decrease in wheat production from 1984 to 1988 following a method of payment change of approximately 5.6% in Southern Alberta. A review of the confidence intervals in the Dunlop study indicates at the lower limit wheat production in Southern Alberta would increase. Also, the coefficients in this equation are stable over time thus providing reliability in the function.[1] The largest decreases would occur in Regions 5 and 6 where wheat production is estimated to have decreased by 42% and 25% respectively. These estimates of large changes in the production of wheat in these regions should be viewed cautiously. Both formulas display a high degree of reliability employing wheat price, canola futures price and barley acres in the determination of wheat production. Barley acres compete with wheat for acreage in both regions while wheat production responds positively to the wheat price changes. Changes in wheat production in regions 4 and 7 have been estimated at 11% and 8%. The three southern regions display an average increase in

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1 The study (Dunlop, 1989) estimates an uncompensated change to a pay the producer method of payment on a sub-regional basis. Supply functions for wheat, barley, and canola are estimated for regions in Western Canada. All estimates are based on annual data from 1965 to 1985, N=21.

production of 15%. In aggregate, over all regions a decrease in wheat production of approximately 200,000T or 4.2% would be expected to have occurred with a change in the method of payment. Comparison of the results in this study to a recent study by Dunlop (1989) indicate from 1984 to 1988 wheat production in Alberta would decrease by approximately 10%. Over the same time period (1984 - 1980), the current study estimates a decrease in production by approximately 6%.

Changes in barley production are also anticipated in response to a changed method of payment. Barley production is expected to increase in Regions 1 and 3, but decrease in all other regions. On average the decrease in production would have been moderate at 2.7%. In the regions in which production increased, the average increase was a substantial 33% when adjusted for the three years in which production would decrease. In region 3 a net increase of 6.2% was estimated. With the exception of region 3 all changes in production are moderate. The changes anticipated in region 3 are extreme and should be interpreted with caution. The direction appears reliable but the magnitude of change is very large and it may take considerable time before farmers would complete the conversion to new production patterns.

In aggregate barley production is expected to increase 2% for the province as a whole in response to a change to a producer method of payment. As most of this increase reflects the substantial change in barley production in region 3, the accuracy of this expectation is dependent on the degree to which farmers increase production in this one

region. If this response in this region is substantially less than estimated, the response for the province may be no change or a slight decrease. Dunlop (1989) estimated from 1984 to 1988 that after a method of payment change barley production in the Province of Alberta could decrease by approximately 14%. The approximate barley production decrease in agriculture reporting areas (ARA) 1, 2, and 3 was 10% during the crop years 1984 to 1988 (Dunlop, 1989). Given the range in the confidence intervals on the price variables (barley and canola) in this research (Dunlop, 1989), would suggest modest decreases in barley production in Southern Alberta.

Canola production is expected to have increased in response to a change to a producer method of payment. Only region 6 shows a decrease, and this only occurred in four out of the past eleven years. Region 5 showed no change in canola production. On average over all years it is estimated that canola production in Alberta would increase 17.5%. The greatest increases in the most recent years was in Regions 3 and 7 where production changes of 25% and 34% were anticipated. Region 6 displayed the least response varying from a 12% increase to a 12% decrease over the past three years.

Such a change does not appear unreasonable as the change in the freight rate paid by farmers, and in turn the lower initial payments, would be a smaller proportion of the total canola price than it would be of the price for the other crops analyzed. This situation could be expected to drive the production of barley down because the freight costs after a

change to a pay the producer method of payment will be a large proportion of the price of the grain. The response observed is small relative to what one would expect given the price/freight situation. This is likely the result of the significant increases which have occurred in barley yields. Barley yields doubled in most regions over the past ten years.

From 1984 to 1988 Dunlop (1989) estimated a decrease in canola production in the Province of Alberta, approximately 2%. It is also noteworthy that the majority of the decrease comes from agriculture reporting areas (ARA) 4, 5, and 6. In Regions 1, 2, 3 and 7, Dunlop (1989) estimates an increase in canola production.

The results for oats in Region 5 were mixed with oat production declining in four years and increasing in seven years. The average change during years in which production increased was 717,000 bu or 11.1 thousand tonnes. During the years in which production decreased the average decrease was 260,000 bu or 4,000T. The response in oat production in 1988 was exceptionally large at 6.5 million bushels. The next largest response was 1.6 million bu in 1984. The 6.5 million bushel response is extreme and should be interpreted with caution, but it does suggest that oat production is very responsive to a change in the MOP.

The producer method of payment results are generally not sensitive to a change in the grain transportation subsidy coefficient. Region 1 appears most sensitive to a 5% change in the government transportation coefficient and the price decrease which, given the lack of alternatives to grain farmers in the region, seems reasonable.

The results from a producer method of payment appear to be insensitive to a change in the coefficient on price, as well as the coefficient on lagged barley acres in the wheat equation in Region 1.

B. Returns Above Variable Cost

The analysis of the impact a change to a producer method of payment would have had on farmers in Alberta included a determination of the change in producer returns above their variable costs. Within the economic discipline this measurement is titled the "producer surplus", and is considered to be a measurement of the "welfare" farmers receive when marketing their products. A change in producer surplus is thus considered to be a change in the welfare of farmers. Because the definition of producer welfare is restricted to revenue received from the market place, the "Crow Benefit" payment to the railways is included in the actual or baseline scenario as the railway payment is reflected in the price of the crops, e.g., the initial payment for wheat at the elevator.

On changing the method of payment to a producer payment, the farmers returns from the market, such as the initial payments for the various crops, will decrease so his producer surplus or welfare will decline. The payment of his crow benefit directly will be made remote from the market so this payment will not be included in the producer surplus calculations. A gross revenue calculation will be made later in this study, and this calculation will include the Crow Benefit payment made directly to the farmer.

The following discussion will thus be evaluating the impact a change in the method of payment will have on farmers returns from the market above the variable cost involved in producing these crops. Again it is noted that the Crow Benefit payment is included in the market returns before changing the method of payment, but in this calculation is excluded from the calculations which reflect the situation after the method of payment is changed.

Changes in the returns above variable costs (Producer Surplus) in response to a change to a producer method of payment were primarily related to the specific crops. The producer surplus for wheat reduced from 7% to 23% over the eleven years studied averaging a 16% reduction when compared to the current MOP situation. With barley the producer surplus also declined. This reduction varied from 27 to 53% averaging 36%. The producer surplus for canola increased in all years studied where the magnitude of this increase averaged 11% with a range from 5 to 19%. The table below displays the aggregate change in producer surplus of each crop in all regions of the province over the eleven years studied. The producer surplus in oats in the one region in which it was studied decreased over the years from 12 to 39% with an average decrease of 27%.

Percent Change in Producer Surplus from a Change to a
Pay the Producer Method of Payment
(No compensation included with the MOP change)

Year	Wheat	Barley	Canola	Oats
1978	-14%	-28%	+ 5%	-20%
1979	-16%	-36	+ 8	-27
1980	-14	-35	+ 8	-23
1981	-18	-27	+19	-30
1982	-16	-31	+17	-32
1983	-10	-32	+16	-31
1984	-20	-37	+12	-21
1985	- 7	-31	+11	-30
1986	-18	-34	+ 5	-30
1987	-21	-52	+12	-39
1988	-23	-53	+ 9	-12

The actual producer surplus for each crop for the province is displayed in the graphs which follow.

A comparison of the change in the producer surplus in each region shows there were differences depending on the region. An aggregate of the change in producer surplus aggregating all eleven years is as follows:

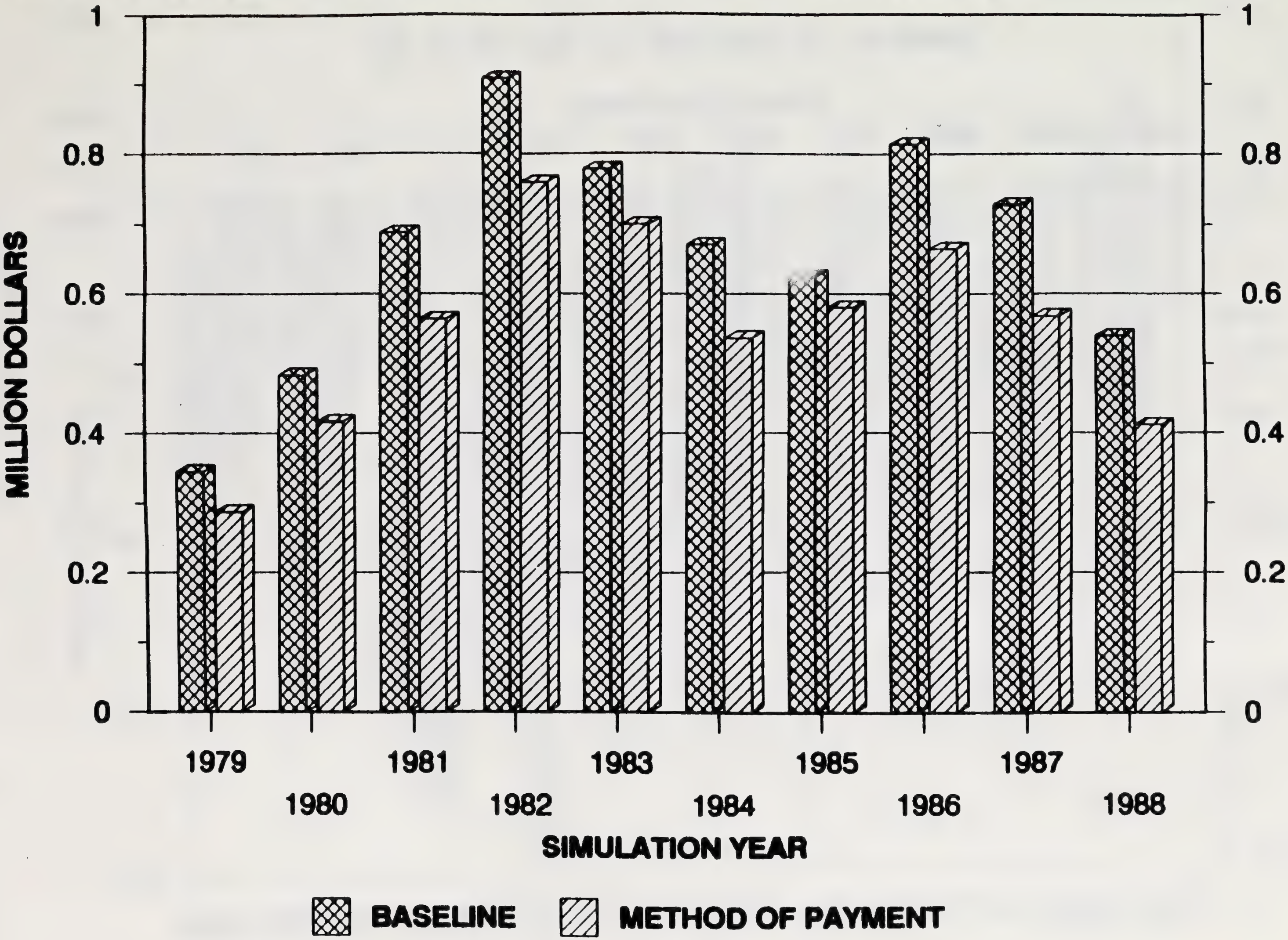
Region 1	12%	decrease
Region 2	9%	decrease
Region 3	5%	decrease
Region 4	3%	decrease
Region 5	19%	decrease
Region 6	16%	decrease
Region 7	2%	decrease

These variations primarily represent the different crops grown in the various regions, and the manner in which the crop production patterns are expected to change with a change to a pay the producer method of payment. These changes suggest that the market returns to farmers above variable

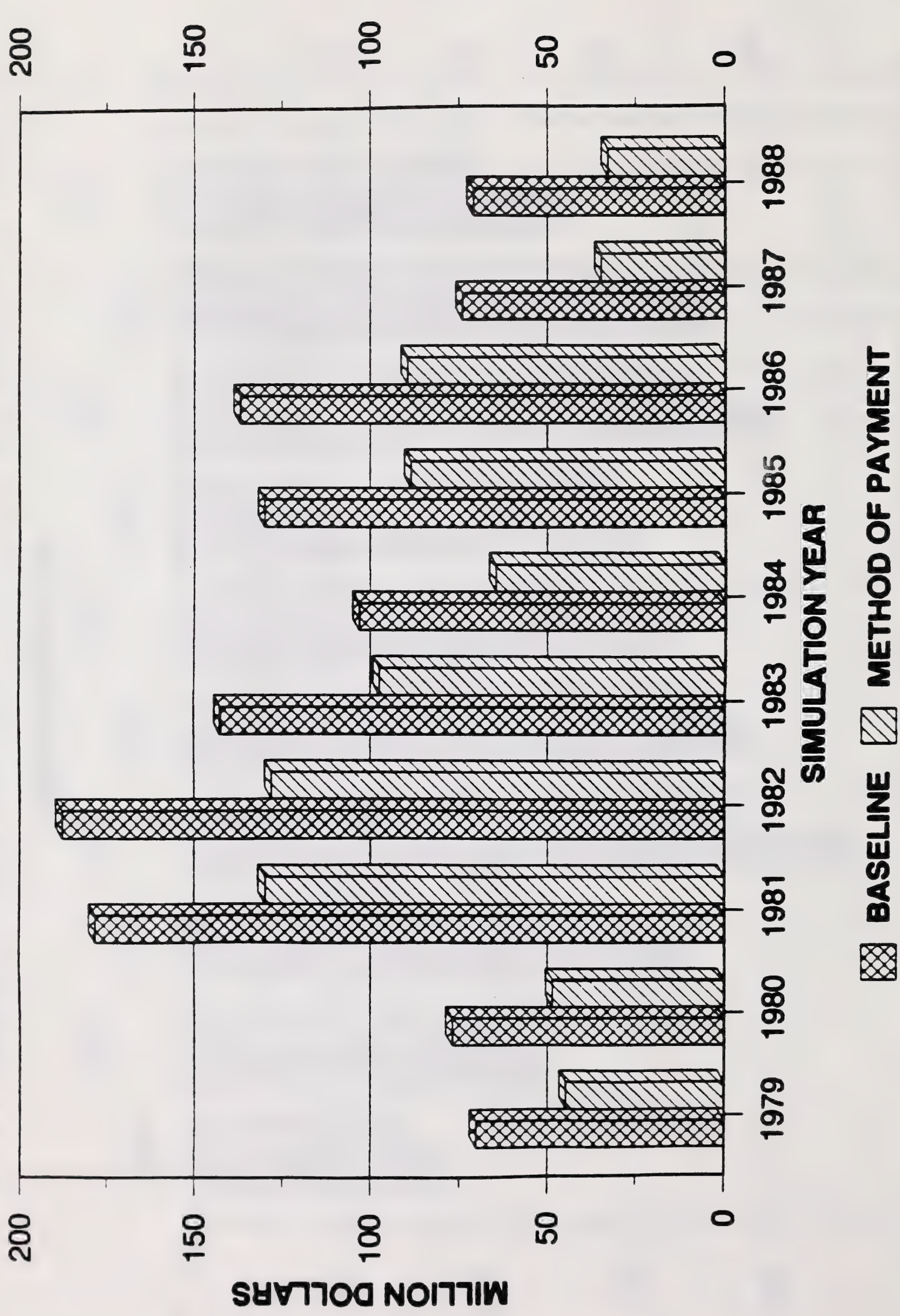
cost would have dropped in all regions, but the amount of the decrease relative to the present situation varies from 2% to 19%. Overall, an 8.5% change in the producer surplus would have been expected for the province.

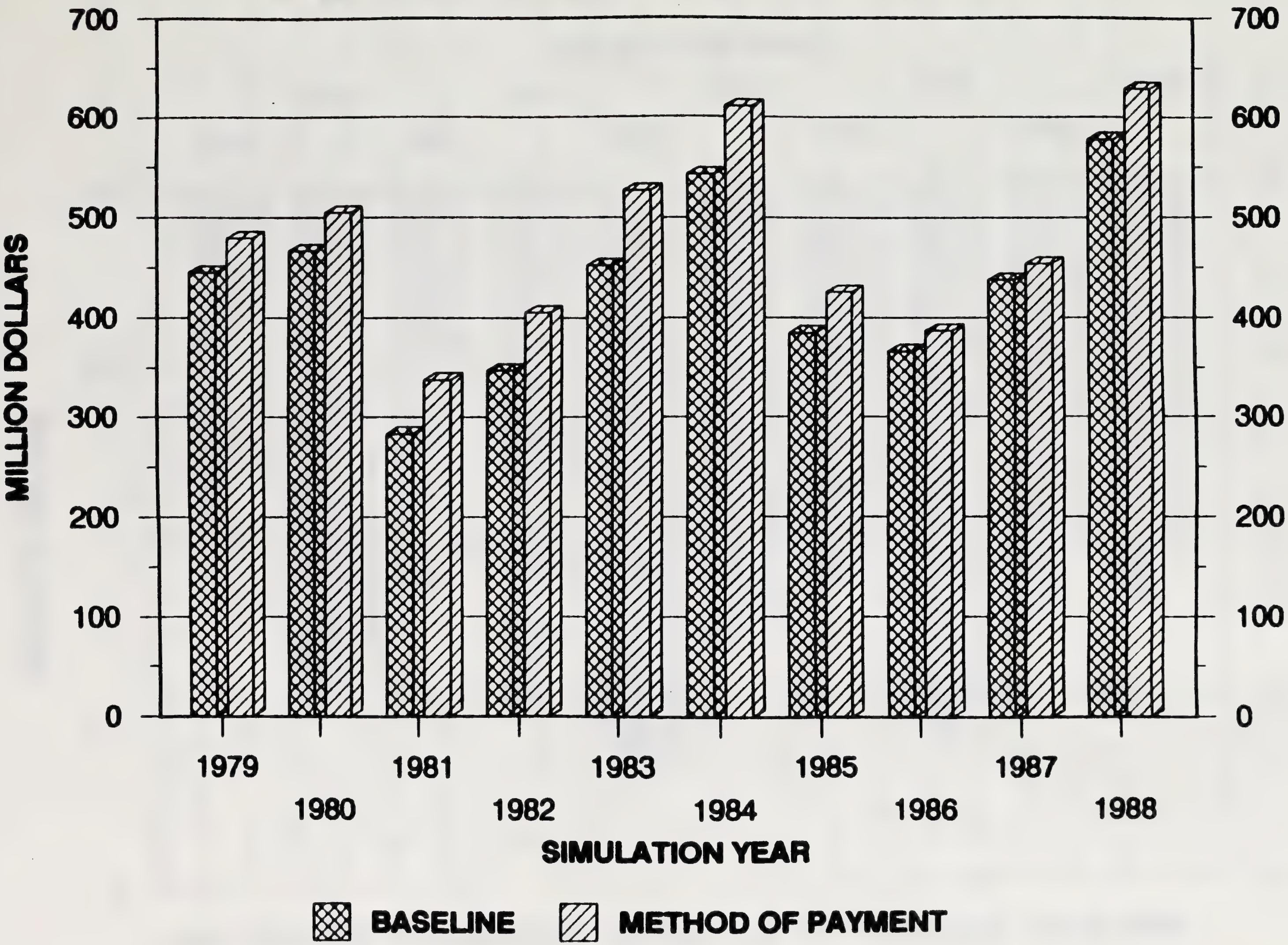
The 8.5% differs from the average change of the above reported percentages in that the provincial average is a weighted average including the change in producer surplus overall, regions and in all years, and comparing this change with the producer surplus under the current method of payment.

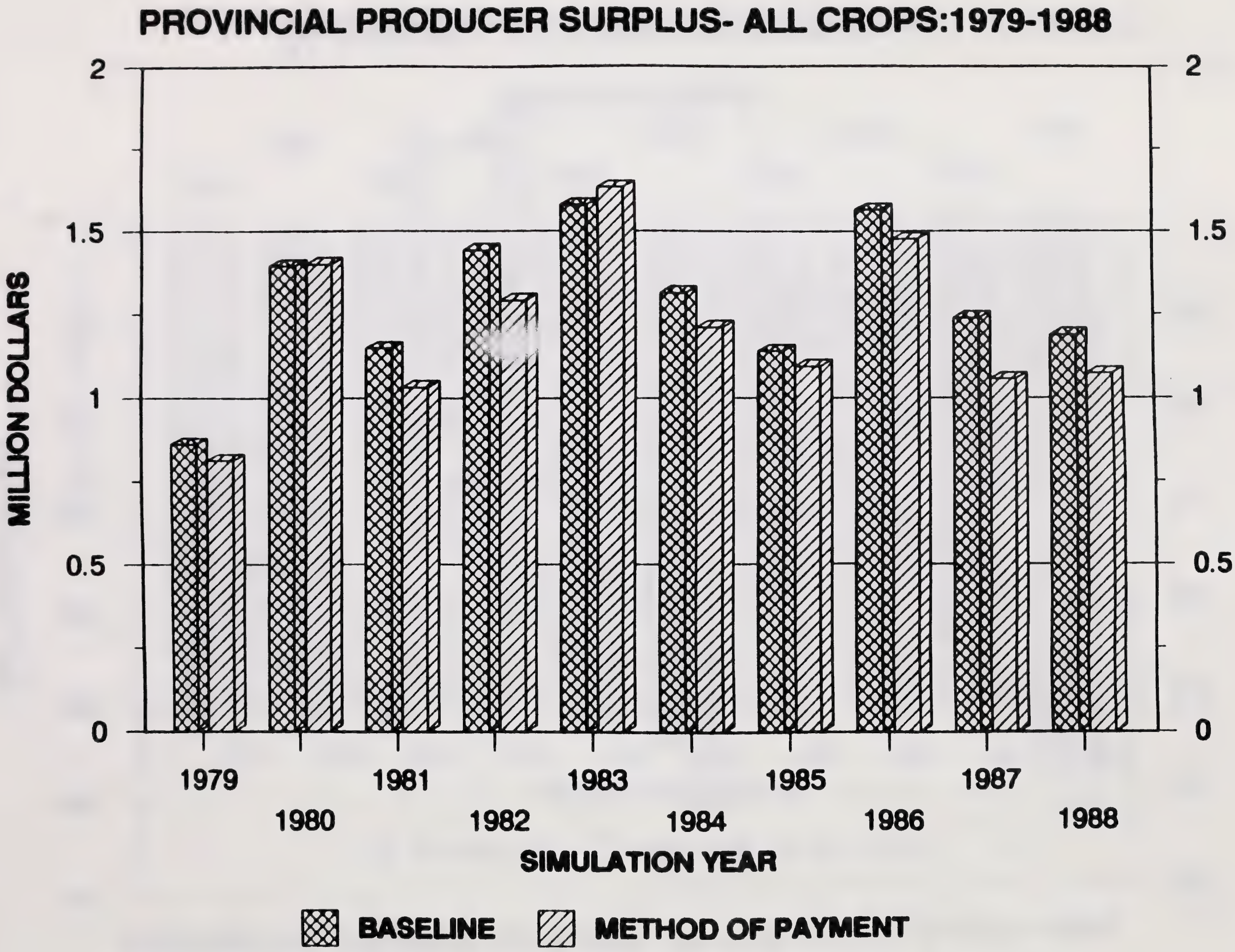
PROVINCIAL PRODUCER SURPLUS FOR WHEAT: 1979-1988



PROVINCIAL PRODUCER SURPLUS FOR BARLEY:1979-1988




MILLION DOLLARS
700
600
500
400
300
200
100
0
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
SIMULATION YEAR
BASELINE
METHOD OF PAYMENT


PROVINCIAL PRODUCER SURPLUS- ALL CROPS:1979-1988
MILLION DOLLARS
2
1.5
1
0.5
0
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
SIMULATION YEAR
BASELINE
METHOD OF PAYMENT

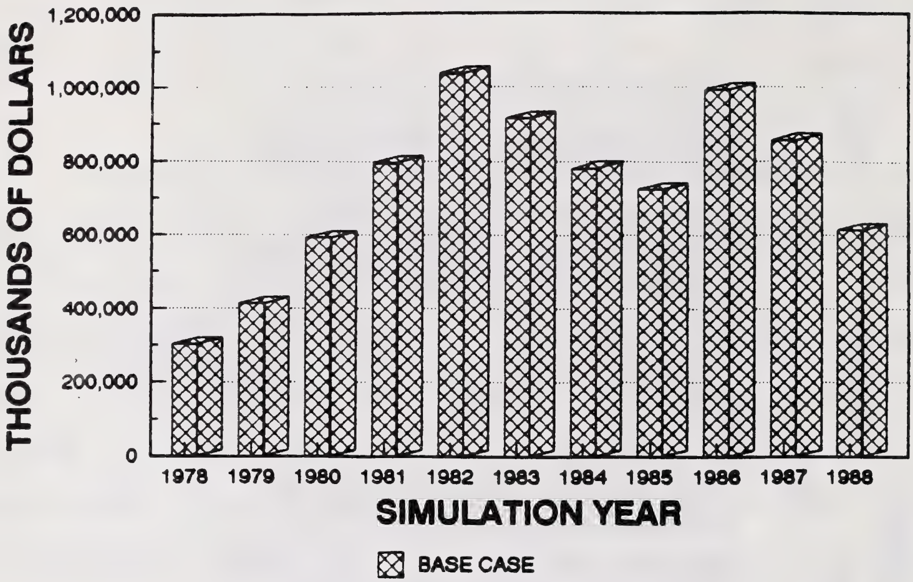
C. Revenue changes due to a change to a Pay the Producer Method of Payment

Although the producer surplus calculations are a valuable guide to the effect a change in the MOP will have on the farmers returns above variable costs, it has an inherent weakness in this application. Producer surplus only measures returns from the market so the payments of the Crow Benefit directly to producers are not included. It is invalid to add those crow funds directly to the producer surplus as this would suggest that the Crow Benefit payments were in every instance returns above the variable cost. Although this does appear to be true in the time period studied, this assumption will not be made.

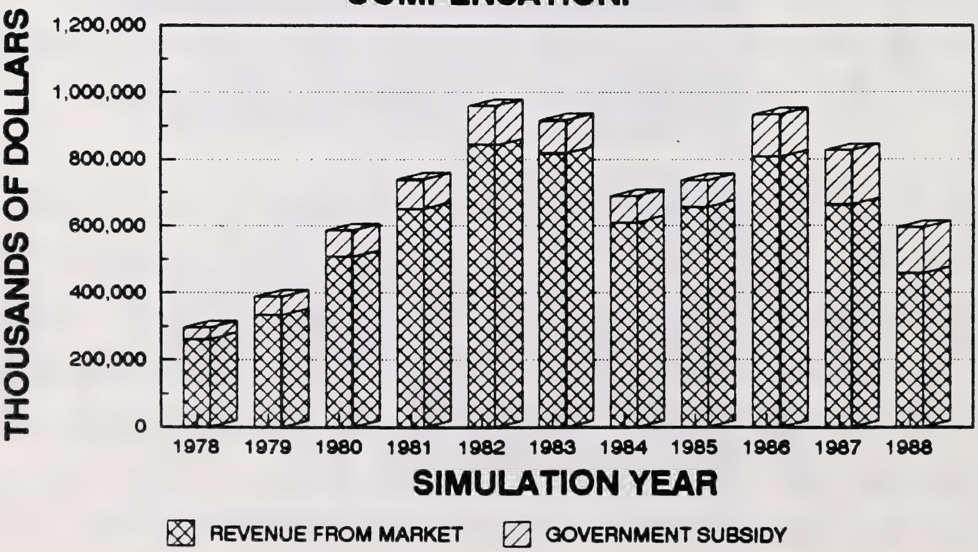
In order to incorporate the Crow Benefit payments in this analysis it was decided that the gross revenue received by farmers would be evaluated before and after a change to a pay the producer method of payment.

The following charts display the estimated change in the gross revenue for grain as a result of a change to a producer method of payment. These charts display all three crops over all ten years studied. The base case is the current and past situation with the payments of the Crow Benefit being made to the railway. The comparative chart shows the average revenue from each crop with the payment being made directly to the producer and with the changes in production patterns as explained in the earlier analysis.

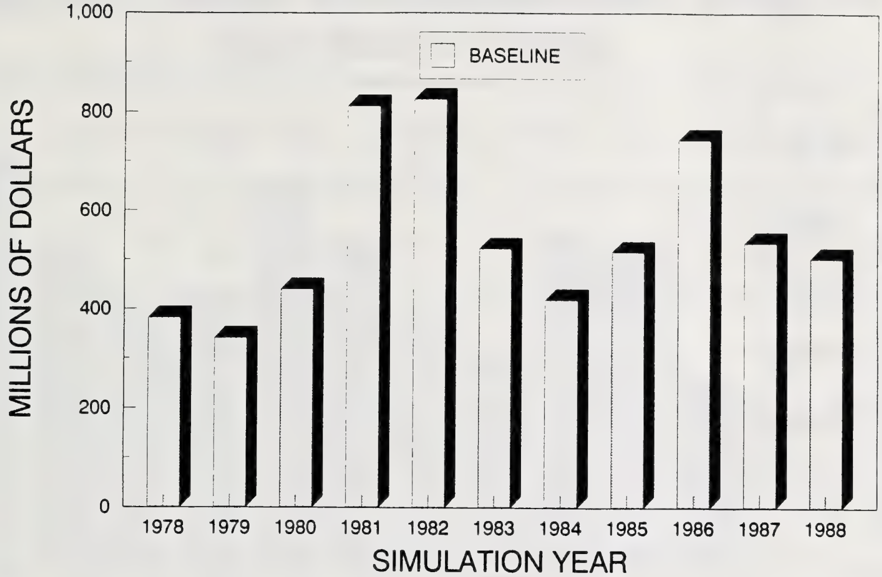
PROVINCIAL GROSS REVENUE FOR WHEAT (1978-1988) UNDER THE BASE CASE



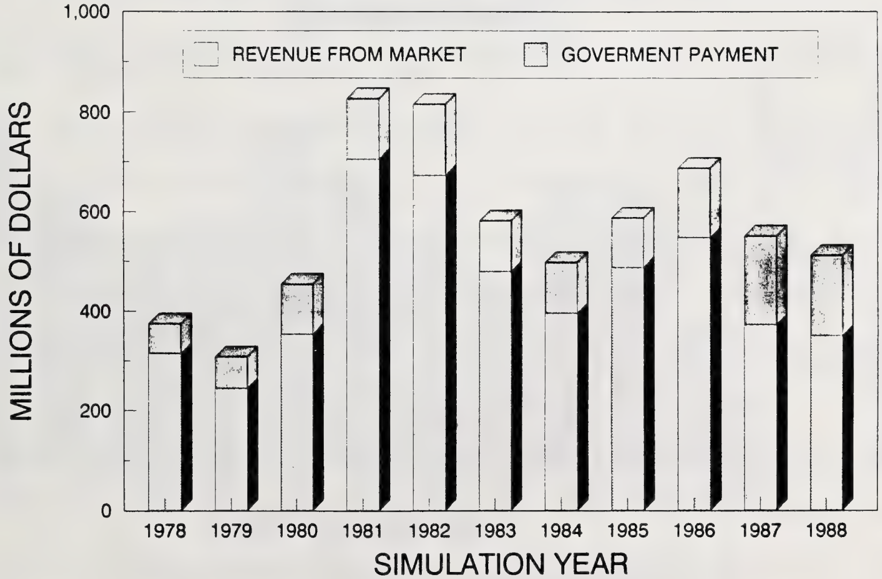
PROVINCIAL GROSS REVENUE FOR WHEAT (1978-1988) UNDER A METHOD OF PAYMENT CHANGE WITH COMPENSATION.



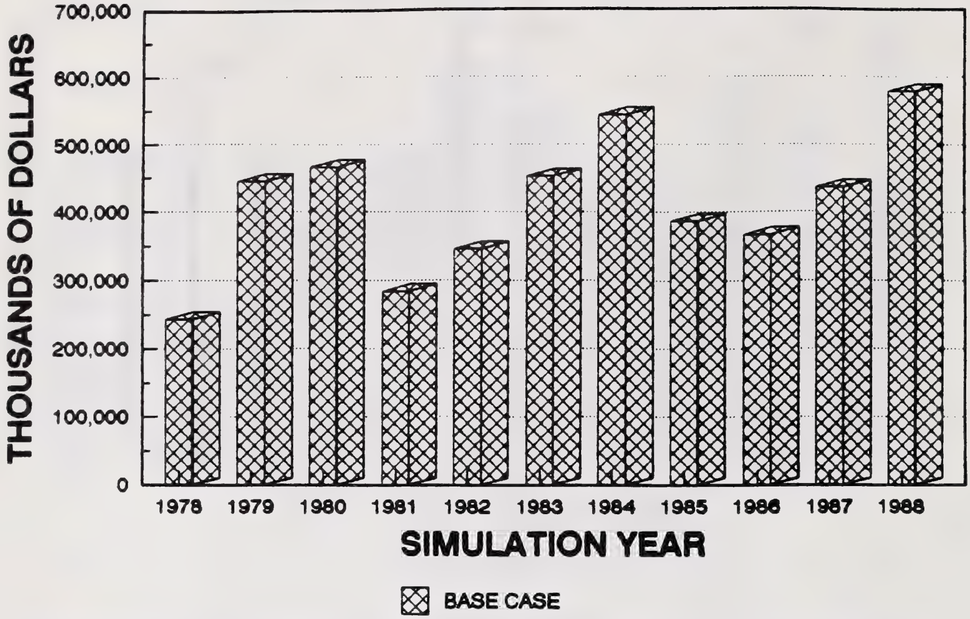
PROVINCIAL GROSS REVENUE FOR BARLEY UNDER BASELINE OVER THE PERIOD 1978 TO 1988.



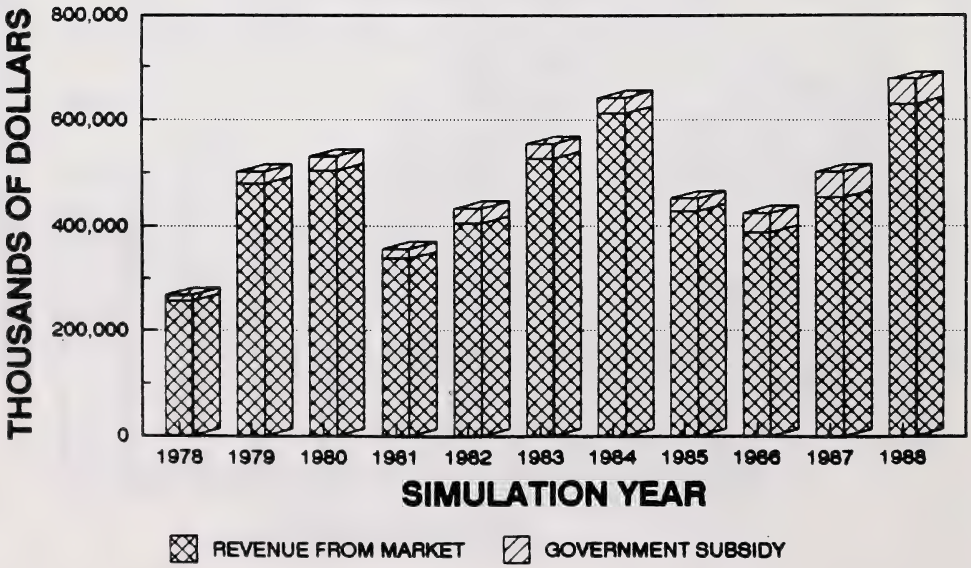
PROVINCIAL GROSS REVENUE FOR BARLEY UNDER A PRODUCER METHOD OF PAYMENT FROM 1978 TO 1988.



PROVINCIAL GROSS REVENUE FOR CANOLA (1978-1988) UNDER THE BASE CASE



PROVINCIAL GROSS REVENUE FOR CANOLA (1978-1988) UNDER A METHOD OF PAYMENT CHANGE WITH COMPENSATION



1. Gross Revenue Changes for Wheat.

The chart displays that the gross revenue received by farmers for their wheat would have reduced after a change to a producer method of payment. In only two years out of the last ten did the revenue from wheat sales increase. These increases averaged $6 million. In the remaining eight years revenue reduced an average of $45.4 million which is equal to 5.8% of the average revenue. The sensitivity of the calculation of revenues to grain producers are in a direct relation to the sensitivities previously discussed on grain production. For example, wheat production in the Province of Alberta decreased by approximately 5.6% with a 5% decrease in the GTRAN coefficient. This in turn resulted in a 5.6% decline in revenue from wheat sales. Appendix D shows the sensitivities in revenues to wheat producers due to changes in the GTRAN coefficients.

2. Gross Revenue Changes for Barley.

The gross revenue farmers receive from the sale of barley to the Board was expected to have increased following a change to a producer method of payment. In seven years out of the past ten, revenues would have increased an average of $15.9 million. This amounts to a 4.7% increase in gross revenue on average as a result of a change to a producer method of payment. The largest increase was in 1985 when revenues would have increased 13% with the changed method of payment. Gross revenues from the sale of barley to the off-Board market would show further increases in returns. The assumption used here is that producers would deliver their barley to the higher price market

(Board or off-Board), thereby ensuring increases in farm gate returns from barley sales. As discussed earlier this estimated increase stems from a substantial increase in barley production in Region 3.

3. Gross Revenue Changes for Canola.

As displayed in the graph, the gross revenue from canola would increase after a change to a pay the producer method of payment. These changes are substantial varying from an increase of $64 million in 1980 to $101 million in 1983 and $98 million in 1988. The average change in revenue over the ten years was an increase of $76.8 million. This anticipated change is an increase of 30% in revenue as a result of a producer method of payment.

4. Gross Revenue Changes for All Crops.

This analysis suggests that the provincial gross revenue from the sale of crops would increase in response to a change to a producer method of payment. These increases vary from an estimated $162 million in 1983 to $2 million in 1982. The average increase over the ten years studied was $54.4 million, an increase of 3% in the gross revenue of farmers from the sale of the crops studied.

5. Regional Changes in Gross Revenue From a Change to a Pay the Producer Method of Payment.

The following table displays the estimated changes which would occur as a result of a change to a producer method of payment

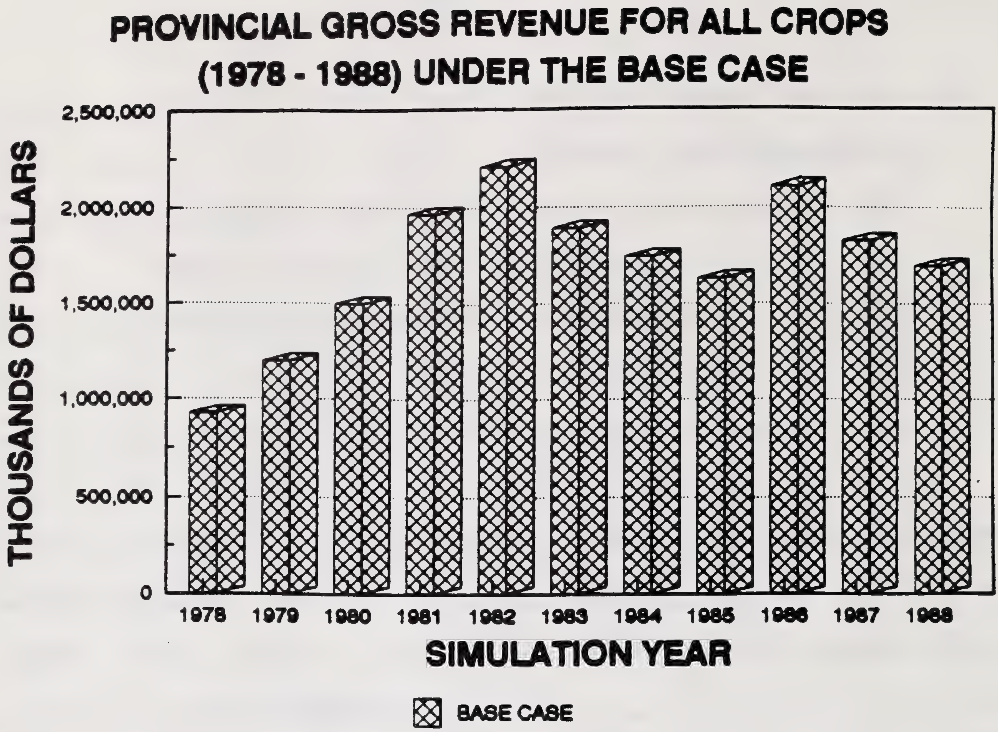
Average Changes in Gross Revenue (1978-1988)

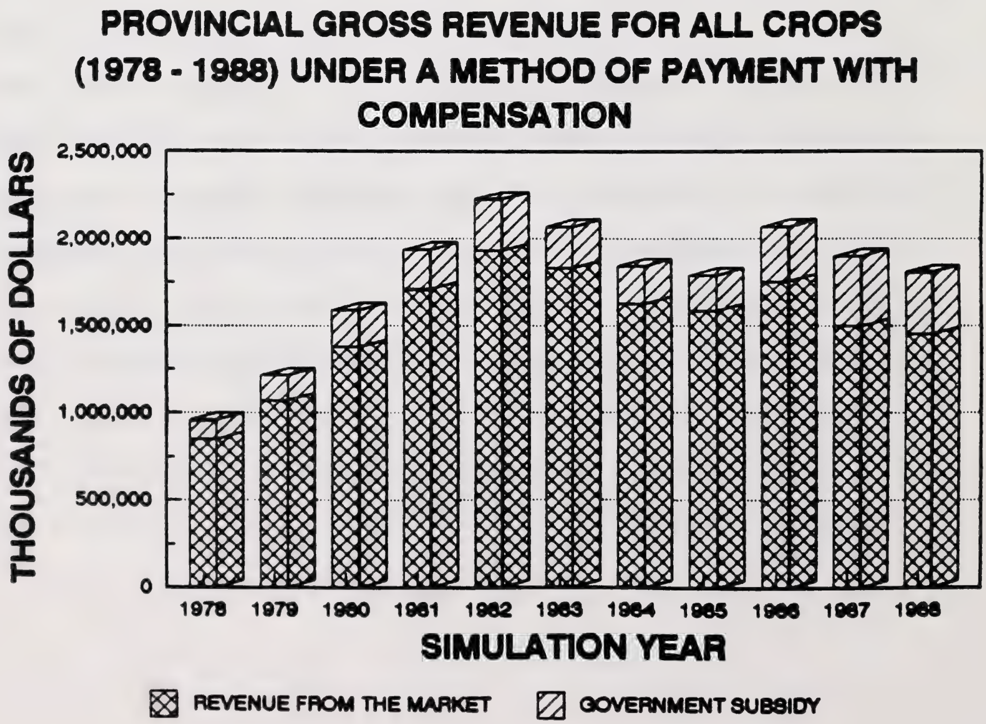
(000$)

Regions

	1	2	3	4	5	6	7	Prov.
heat	566.0	8427.7	4297.1	-22101.8	-12643.6	-6077.1	-4984.6	-32516.2
arley	556.6	-1044.2	25379.2	-929.5	-4803.2	-3480.6	-1756.2	13922.0
anola	884.3	8872.0	7828.7	29994.3	0.0	500.5	24033.9	72113.6
ats					864.7			864.7
OTAL	2007	16256	37505	6963	-16582	-9057	17293	53519

This table shows that Regions 1, 2, 3, 4 and 7 would realize increases in their gross revenue from the sale of crops after a change to a producer method of paymeant. Regions 5 and 6 would experience decreases. It is noteworthy that canola is the only crop which experiences increases in revenue in all regions. The sensitivity of the responses of barley in Region 3, where a 5% change in price or the transportation variable resulted in a greater than 5% change in production, should be considered. Similarly the lack of a response in canola production in Region 5 should also be noted.


PROVINCIAL GROSS REVENUE FOR ALL CROPS
(1978 - 1988) UNDER THE BASE CASE
THOUSANDS OF DOLLARS
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988
SIMULATION YEAR
BASE CASE


PROVINCIAL GROSS REVENUE FOR ALL CROPS
(1978 - 1988) UNDER A METHOD OF PAYMENT WITH COMPENSATION
THOUSANDS OF DOLLARS
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988
SIMULATION YEAR
REVENUE FROM THE MARKET
GOVERNMENT SUBSIDY

D. Grain Prices and the Price Distortion

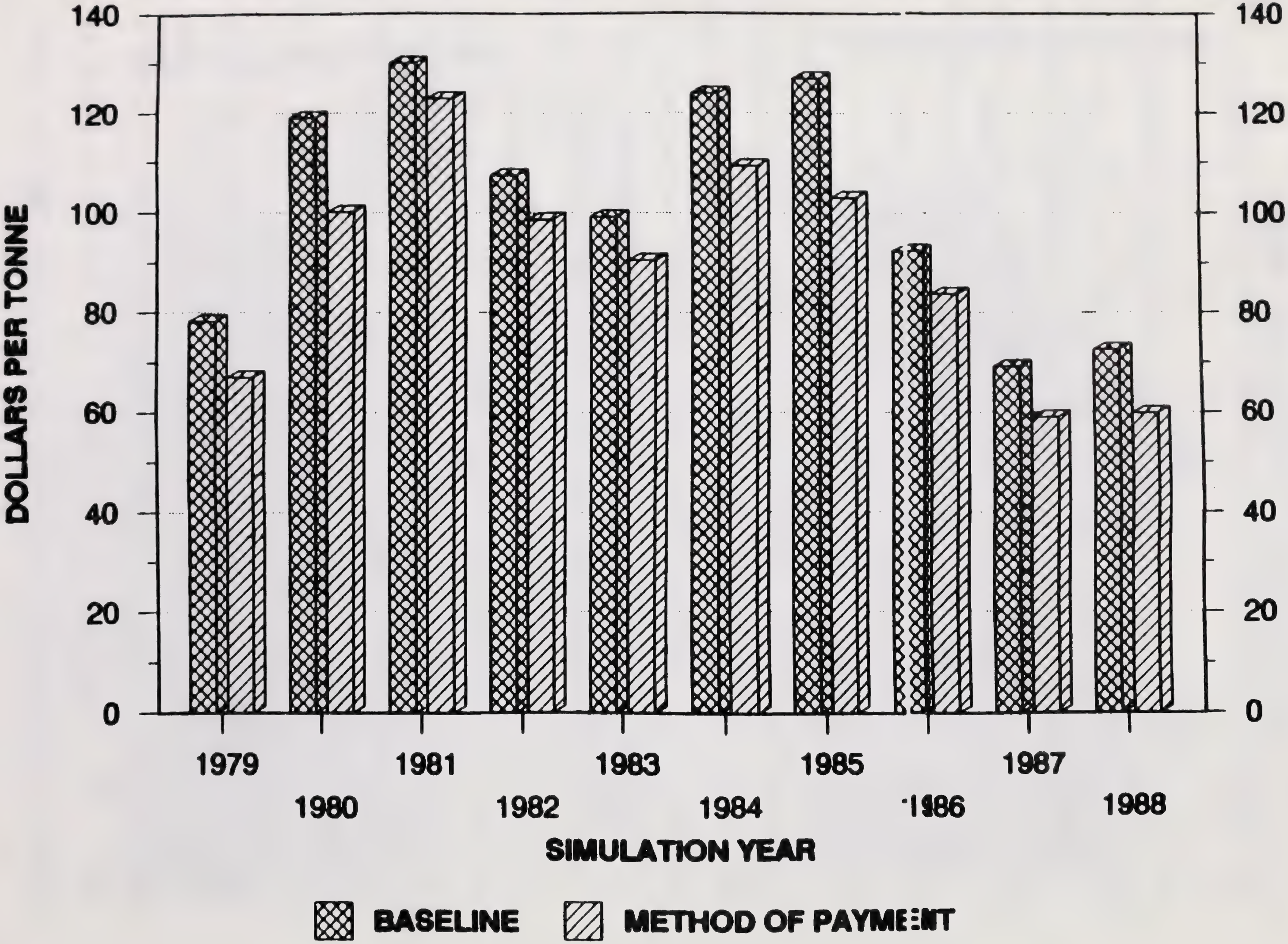
Previous research into the impact of the current method of payment has suggested that all or a portion of the payment to the railway gets reflected in the local price of feedgrains. It is hypothesized that the price of grain for local sales is inflated and distorted by the railway payment. Most research has substantiated this claim, but the degree of the price inflation (distortion) is still under debate.

In an effort to quantify the distortion, the model was designed such that the off-Board barley price could be determined at the baseline reflecting the payment going to the railway, and with the payment being made directly to the producers. The difference between the two prices is defined as the price distortion. Barley was selected as it is the main grain being fed in the province with over 3 million tonnes fed annually.

The chart titled "Average Provincial OffBoard Prices" displays the price of barley at the baseline with the payment going to the railway, and under method of payment with the farmers receiving the Crow Benefit funds directly.

From this graph it is apparent that local off-Board barley prices are inflated by the current method of payment. The degree of this price inflation or distortion varies from $7.10 per tonne in 1981 to $23.79 in 1985. The average distortion is $12.47. The analysis estimated the distortion for the first seven months in 1988 to be $12.78 per tonne.

AVERAGE PROVINCIAL OFFBOARD PRICES (1979-1988)



This analysis sets the distortion at less than the $23.50 paid by the government to the railway. The method of determining the distortion within the analysis was to develop an econometric equation which would approximate the actual off-Board price at 99% accuracy. These formulas contained as an independent variable the net initial Canadian Wheat Board payment at seven locations across Alberta. Other variables included in the equation were adjustment payments, the log of the stocks/use ratio and the previous month's off-Board price.

The baseline calculation included the initial payment with only the producer share of the freight deducted. The method of payment calculation involved the same formula, but the initial payment was decreased to reflect the farmers paying the full cost of freight. For example: if the current producer share of freight were $7.00/T then $7.00 was deducted from the initial payment in the determination of the baseline barley price. When the barley price was calculated to reflect the change to a producer method of payment the same equation was employed, but the freight deducted from the initial payment was the full cost of freight which in this example would be approximately $30/T.

The Winnipeg Commodity Exchange barley futures contract recently reflected a situation similar to this. It was recently announced that the initial price of barley will drop $35/T as of August 1 of this year. This decrease could be expected to drop the off-Board price of barley $35/T. As of July 4 this year the price of July barley was $116/T and

October barley $106.50, a $9.50 difference although sales to the Canadian Wheat Board will receive an initial payment $35/T lower in October than it would in July.

E. Livestock Results

Aside from the changes in crop production which are anticipated from a change to a pay the producer method of payment, changes in livestock production are expected. These changes would come mainly from the changes in the feedgrain price. As was displayed earlier, a reduction in feedgrain prices was estimated after the method of payment is changed to a producer payment. This decrease in feed (barley) prices will then be reflected in the price of feeder cattle and calves. This inverse relationship between the price of feed barley and the price of feeder cattle stems from the high proportion (55%) feed costs are of the total cost of feeding cattle through to finished weights. The feeding industry has a standard or pattern of bidding the price of feeder cattle up toward what is referred to as the "break even price". The break even price is the maximum price which can be paid for feeder cattle in order that the cost of the feeder, plus the cost of feeding the animals through to finished weight, is equal to the anticipated returns from the finished animal at the anticipated slaughter cattle price. Variances in the cost of feeding and the slaughter cattle price are thereby transferred through to the feeder cattle and calf prices. With extensive export markets readily accessible to the grain farmer, there is little opportunity to force down the feedgrain price. The feeders instead concentrate on the

price of feeders to compensate for changes in feedgrain prices. If the price of feed barley decreases feeders will pay more for feeder cattle, and if barley prices increase they will tend to pay less. It is through this relationship between the price of feed barley and the price of feeder cattle (calves) that a change to a producer method of payment and the associated decrease in barley prices is expected to change the pattern of feeding cattle in the province.

In the first year after a change to a producer payment, calf prices can be expected to increase, whether the calves are being backgrounded (prepared for the feedlot) or placed directly into the feedlot. As the buying pressure increases in response to the aggressive bidding by farmers feeding cattle the price of heifer calves begins to respond. The female calves have two markets they may be placed in, a feedlot or retained or sold as breeding stock, in either case they now command a higher price.

If farmers expect this increase in the calf price to be a permanent, or at least a long term trend, farmers with cow herds will have a tendency to increase the size of their herds by removing heifers from the feeder cattle market and retaining them on the farm as replacement heifers. Other farmers will purchase breeding stock with the intention of building a cow herd. This action results in a decrease in the number of cattle available for feeding and amplifies the price rise.

In time, approximately three years, the heifer calf retained for breeding purposes will have produced a calf and be included in cow inventory numbers.

In this analysis the impact of a direct to producer method of payment on the livestock industry is analysed. This analysis includes estimates of the change which would occur in the following classes of livestock as a result of a change to a producer payment. The classes of livestock analysed include:

- calf prices,
- feeder cattle numbers and feeder cattle prices,
- heifer replacement inventory,
- cow inventory,
- imports and exports of feeder cattle and slaughter cattle, carcass weight.

This comparison is conducted using the actual situation which includes the Alberta Crow Benefit Offset Program (ACBOP) from 1985 to 1988. The ACBOP program is included as a $21 reduction in feedgrain costs in the last quarter of 1985, 1986 and the first two quarters of 1987 and $13 thereafter.

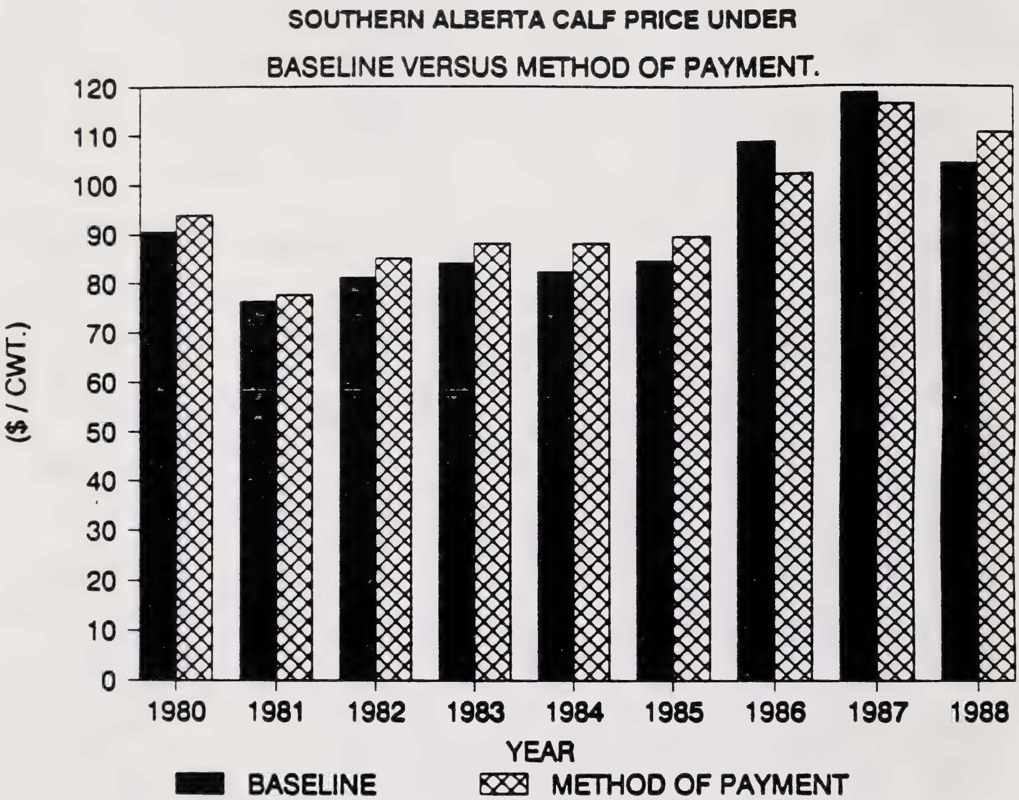
1. The Impact of a Change to a Producer Method of Payment on Calf Prices

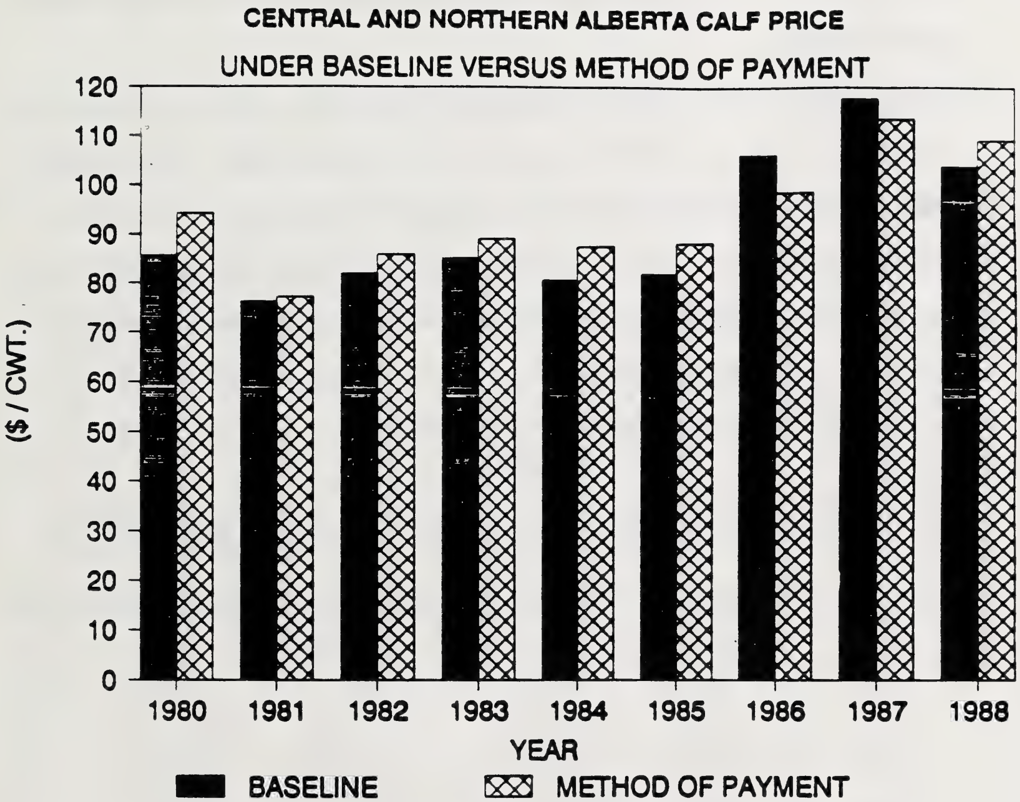
   An analysis of the situation following a change to a producer payment suggests that a change in calf prices will occur. The estimated changes for calf prices in southern and central and northern Alberta are presented in the following table and graphs.

CALF PRICES
($/CWT)

	Southern Alberta Calf Prices			Central and Northern Alberta Calf Prices		
	Baseline	MOP Changed	% Change	Baseline	MOP Changed	% Change
980	90.55	93.84	+3.6	85.57	94.16	+10.1
981	76.32	77.73	+1.8	76.20	77.29	+1.4
982	81.16	85.09	+4.8	81.96	85.95	+4.9
983	84.17	88.10	+4.7	85.20	89.14	+4.6
984	82.36	88.16	+7.0	80.79	87.61	+8.4
985	84.62	89.68	+6.0	82.01	88.34	+7.7
986	108.80	102.18	-6.1	106.28	98.61	-7.2
987	118.54	116.28	-1.9	117.57	113.44	-3.5
988	104.26	110.57	+6.1	103.89	109.29	+5.2

This analysis suggests that a change to a producer payment would have resulted in an increase in calf prices. As the above data displays, there were two years 1986, 1987 in which calf prices after the change would be less than the actual prices which occurred. It is noteworthy that in these two years the ACBOP payments were reducing the cost of feedgrain to the cattle feeder by $21/T. An estimate of the distortion in these years as reported earlier in this study suggests that the barley price distortion in 1986 and 1987 was $8.72 and $10.32/T. In 1988 the payment under ACBOP was reduced to $13.00 and the distortion is estimated at $12.78. It would appear that the $21 payment through ACBOP during a period when the distortion was in the $8-$10 range would explain why the analysis shows a decrease in calf prices in these two years after a change to a producer payment and the elimination of the ACBOP Program. As would be expected, the years which display the greatest change in calf prices as a result of changing the MOP are years in which the distortion was the greatest. The average increase in calf prices is estimated at $2.25 per cwt.


SOUTHERN ALBERTA CALF PRICE UNDER
BASELINE VERSUS METHOD OF PAYMENT.
($ / CWT.)
0
10
20
30
40
50
60
70
80
90
100
110
120
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR
BASELINE
METHOD OF PAYMENT


CENTRAL AND NORTHERN ALBERTA CALF PRICE
UNDER BASELINE VERSUS METHOD OF PAYMENT
($ / CWT.)
0
10
20
30
40
50
60
70
80
90
100
110
120
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR
BASELINE
METHOD OF PAYMENT

The analysis of calf prices found that calf prices throughout Alberta have mainly responded to the calf price of the previous quarter, the steer price, the price of barley and the ACBOP payments.

2. The Impact of a Change to a Producer Method of Payment on Feeder Cattle Prices

An analysis of the effect a change to a producer method of payment would have had on feeder cattle prices shows that feeder cattle (800-900 lbs.) prices would have changed with a change to a producer method of payment. The following table displays the changes which would be expected to occur in response to a change to a pay the producer method of payment.

HEAVY FEEDER CATTLE PRICES
($1 CWT)

	Southern Alberta Feeder Prices			Central and Northern Alberta Feeder Prices		
	Baseline	MOP Changed	% Change	Baseline	MOP Changed	% Change
1980	79.09	84.06	+5.9	77.57	83.96	+8.2
1981	75.01	77.93	+3.8	73.90	76.04	+2.9
1982	76.62	78.80	+2.8	74.72	76.80	+2.8
1983	77.17	80.51	+4.3	75.59	78.21	+3.5
1984	77.35	81.87	+5.8	75.82	79.42	+4.7
1985	73.29	79.85	+8.9	72.66	78.08	+7.5
1986	81.96	79.30	-3.3	80.75	78.64	-2.6
1987	93.33	89.36	-4.4	92.13	89.04	-3.5
1988	93.09	89.60	-3.9	91.04	89.40	-1.8

This analysis suggests that a change to a pay the producer method of payment would have resulted in an overall increase in feeder cattle prices. The data presented above show a decline in feeder cattle prices in the years since the ACBOP program was instituted. The feeder cattle price declines after 1985 are more apparent in the

southern Alberta prices than those in central and northern areas. The average increase in feeder cattle prices was 5% or approximately $4.00 per cwt compared to the period before ACBOP. Such an increase in feeder prices would indicate an advantage to feeding calves to slaughter weight rather than heavy feeders.

3. The Effect of a Change to a Producer Method of Payment on Heifer Replacement Inventory

As explained in the introduction, a change to a producer payment could be expected to result in a change in heifer inventory numbers. In determining the impact of a change to a producer payment it was decided that an analysis of heifer replacement inventory numbers would be useful. The following are the results of this analysis.

AVERAGE CHANGES IN HEIFER REPLACEMENT INVENTORIES (000 Head)

Region	Baseline	MOP Changed	Change
1	30.7	34.6	3.9
2	25.4	30.2	3.8
3	41.5	42.7	1.2
4	40.7	72.1	31.4
5	47.8	60.0	12.1
6	37.7	49.5	11.8
7	14.7	16.6	1.9
TOTAL	238.5	305.7	67.2

It appears from the analysis that heifer replacement inventories will increase in response to a change to a producer payment. The largest increases occur in Regions 4, 5 and 6 with Region 3 showing the least response. It was found that Region 3 has a long term trend toward lower numbers of replacement heifers. Across the province it

was estimated that replacement numbers would increase at an annual rate of 67,000 head per year during the period studied. With the exception of Regions 3 and 7 there appears to have been a gradual but continuous tendency towards increased heifer replacement numbers. Historically, inventory changes of the magnitude observed here have occurred from year to year in the past. The chart on the following page depicts the change in heifer inventories.

4. The Effect of a Change to a Producer Method of Payment on Cow Inventories.

The results of the cow inventory analysis is as follows:

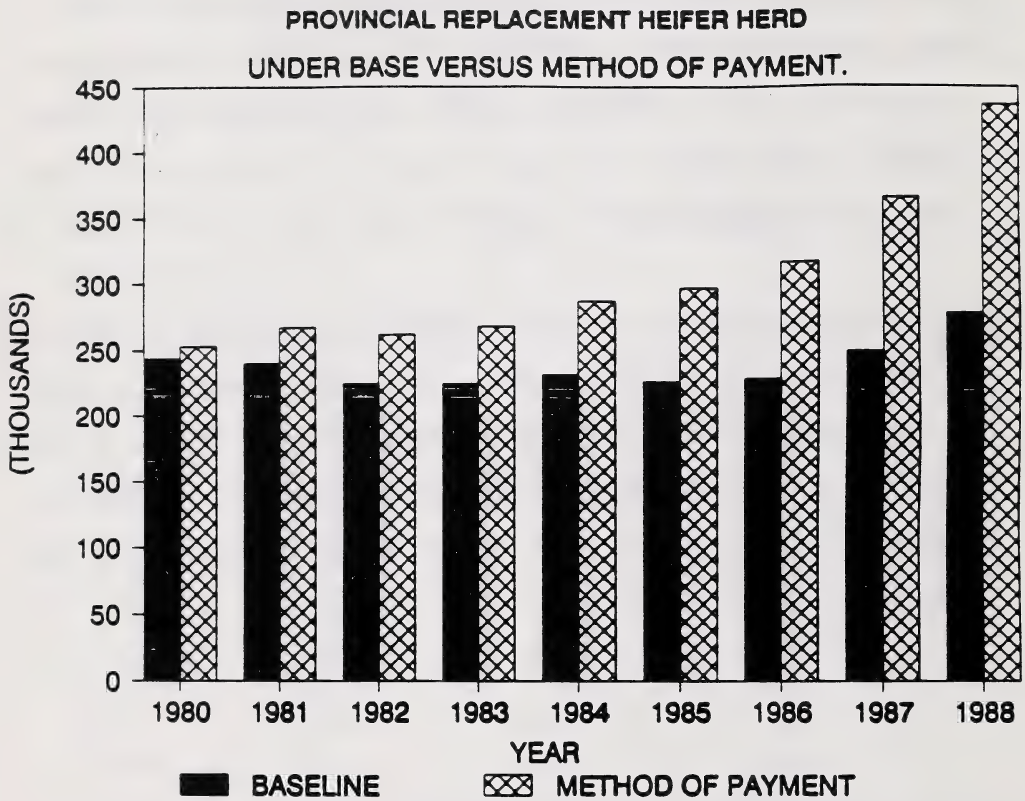
AVERAGE CHANGES IN COW INVENTORIES (000 Head)

Region	Baseline	MOP Changed	Change
1	177.0	194.5	17.5
2	173.5	182.0	8.5
3	226.2	246.3	20.1
4	261.0	324.3	63.3
5	248.6	251.0	2.4
6	218.3	225.0	6.6
7	73.3	78.6	5.3
TOTAL	1377.9	1501.7	123.8

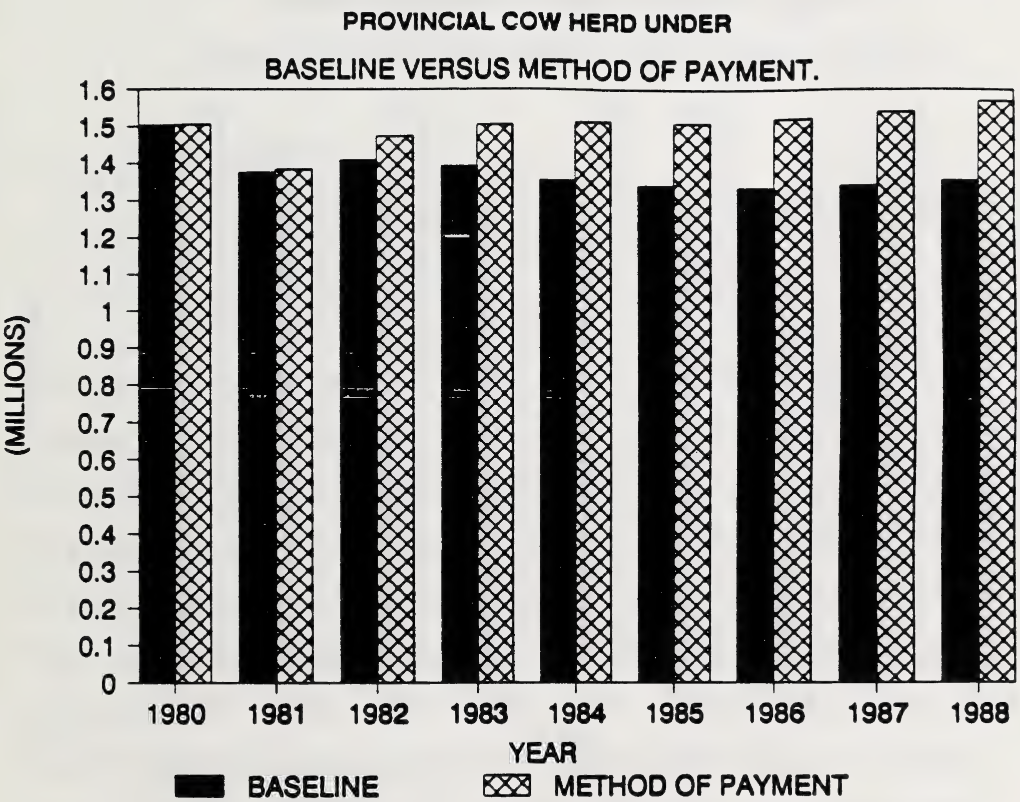
This analysis suggests that cow inventories would have increased in response to a change in the method of payment. The average annual increase was estimated at 123,800 head. The increase varied between regions, with Region 4 showing the greatest increase while Region 5 exhibited the least response. In all regions except Region 4, the increase in cow numbers would be small and gradual. This would be expected in areas with established herds, as much of the herd build up will come from retaining heifers. There are areas of the province

where farms have a history of bringing in large numbers of beef heifers in the fall. These heifers are registered as cows in the inventory the following July, but because they are acquired in the fall they are not included in the previous year's heifer inventory. This situation, which occurs predominantly in Regions 4, 5 and 6, would account for discrepancies which may be noted between heifer inventories and the following year's cow inventory, and sudden changes in cow numbers from year to year. A chart depicting cow inventory changes follows.

The sensitivity analysis indicates Region 1 is sensitive to the size of the coefficient on the lagged cow and heifer inventory variable. A 5% change in the coefficient resulted in a 16% change in the estimated cow herd in Region 1. All other regional results were not sensitive to the coefficients on the variables in each of the equations.



PROVINCIAL REPLACEMENT HEIFER HERD
UNDER BASE VERSUS METHOD OF PAYMENT.
(THOUSANDS)
450
400
350
300
250
200
150
100
50
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR
BASELINE
METHOD OF PAYMENT


PROVINCIAL COW HERD UNDER
BASELINE VERSUS METHOD OF PAYMENT.
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
(MILLIONS)
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR
BASELINE
METHOD OF PAYMENT

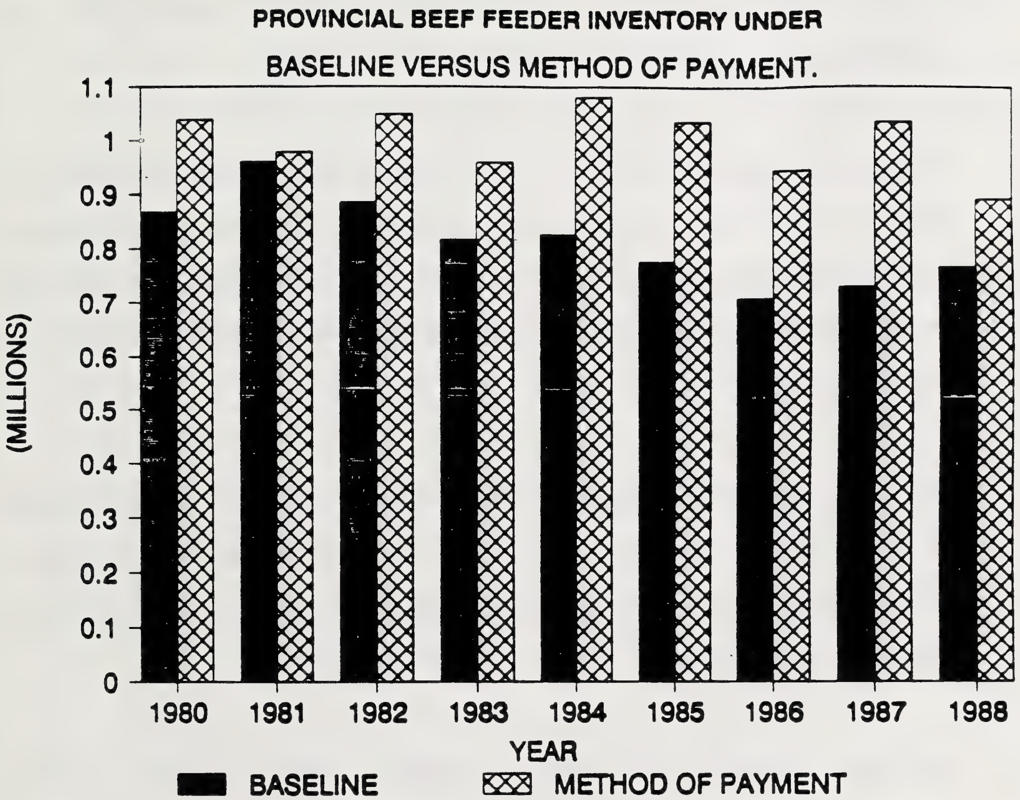
5. Changes in Alberta Feeder Cattle Inventories

The following table shows the changes in the feeder steer and heifer inventories:

AVERAGE FEEDER CATTLE INVENTORIES (000 Head)

Region	Baseline	MOP Changed	Change
1	56.2	56.3	0.1
2	235.5	312.0	76.5
3	143.7	173.7	30.0
4	123.7	166.7	43.0
5	159.7	191.6	31.9
6	78.0	79.0	1.0
7	19.0	22.0	3.0
TOTAL	815.8	1001.3	185.5

This analysis suggests that feeder cattle numbers would have increased in response to a change to a producer method of payment. The change is greatest in Regions 2, 3, 4 and 5, the main feeding areas of the province. Regions 1, 6 and 7 where cattle feeding is not that prevalent showed the least response. The response in Region 2 was very large, but according to cattle feeders in this region such increases are possible. Upon review of the regional differences in feed barley price distortions, it is noteworthy that Region 2 over the past ten years shows the highest average distortion at 1.5 times above the provincial average. A change in the MOP would correct this distortion and attract more cattle feeding to this region.


PROVINCIAL BEEF FEEDER INVENTORY UNDER
BASELINE VERSUS METHOD OF PAYMENT.
(MILLIONS)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR
BASELINE
METHOD OF PAYMENT

6. Changes in the Imports and Exports of Feeder Cattle with a Change to a Producer Method of Payment

Alberta feeders annually import large numbers of feeder cattle into Alberta. These imports come from both Saskatchewan and British Columbia. Unfortunately reliable data on imports from B.C. is not available.

The research was, therefore, restricted to determining the impact a change to a producer payment would have on imports from Saskatchewan. Over the past nine years Alberta has on average imported 171,000 head of feeders from Saskatchewan, the quantities varying from 137,000 to 188,000.

With a change in the method of payment the analysis shows increases in feeder cattle imports will occur. It is estimated that an average of 185,800 cattle per year would have been imported. This is an increase of 14,800 head.

In order to complete the analysis of feeder cattle movements, feeder exports were also analyzed. This analysis showed an average 136,800 head are exported to Ontario annually. Prior to 1985, an average of 159,400 feeder cattle were being exported while after 1985, these exports decreased to an average of 91,400 head. With a change in the method of payment it is estimated that exports of feeder cattle would have declined from 1985 to the present. The present level of exports would be approximately 39,000 head.

7. Changes in the Export of Slaughter Cattle with a change in the Method of Payment

The analysis of the effect a change in the method of payment would have on slaughter cattle exports shows that exports would have remained virtually unchanged in response to the change. Both before and after a change in the method of payment it is estimated that slaughter cattle exports would remain at the average of the past three years, 149,600 head.

8. Changes in the Carcass Weight with a Change in the Method of Payment

The following table displays the changes in the mean warm carcass weight of cattle slaughtered in Alberta from 1980 to 1988.

Changes in Carcass Weight (pounds per head)

Year	Baseline	MOP	Change (lbs)	% Change
1980	617	624	7	1.1
1981	575	577	2	0.4
1982	580	580	0	0
1983	613	615	2	0.3
1984	601	606	5	0.8
1985	603	610	7	1.2
1986	626	629	3	0.4
1987	644	644	0	0
1988	673	673	0	0

This analysis suggests carcass weights would increase marginally with a change to a producer method of payment. The increase ranges from no change to 7 pounds (1.2%). No changes occurring in 1987 and 1988 suggests ACBOP had already resulted in an increase in carcass weights.

F. Breeding Hog Results

An analysis of the hog production situation before and after a change in the method of payment was conducted to determine if changes would occur. This analysis suggests that hog breeding stock numbers would increase moderately in response to a change in the method of payment. Across the province it is estimated that an average annual increase of 2,300 head of breeding stock would have occurred. The largest increases would have occurred in Regions 1, 2, 5 and 6 with estimated annual increases of 400 to 1,300 head. Regions 3, 4 and 7 would virtually remain unchanged. Prior to 1985 a change in the method of payment shows hog numbers would increase 5-10%, while after 1985 this pattern changes and small decreases of 1-2% are predicted.

G. The Effect of ACBOP

Concern has been expressed that with the baseline containing the years in which the ACBOP program was in effect, some of the impact from changing the method of payment may be clouded. In order to offer some insight into this situation an analysis was conducted so as to compare the

baseline with the baseline without ACBOP. As the main impact of ACBOP during the time it has been in effect is the impact on livestock, this analysis is restricted to livestock.

1. Influence of ACBOP on Calf Prices

   The analysis conducted showed the ACBOP resulted in a change in calf prices throughout Alberta. In southern Alberta, calf prices without ACBOP were estimated to be $1.53, $7.11 and $4.63 per cwt less than the baseline prices for the years 1985, 1986 and 1987 respectively. In 1988 the two prices were virtually the same with the baseline being $0.40/cwt lower than the baseline less ACBOP. In central and northern Alberta much the same pattern was evident with "Baseline less ACBOP" prices being lower than the baseline by $9.70 to $3.85 in all years except 1988 where the baseline was slightly above the baseline less ACBOP calf price.

2. Influence of ACBOP on Heifer Replacement Inventories

   Heifer replacement inventories were determined with the ACBOP influence removed. This analysis showed that heifer inventories would decrease from the baseline in every year. The provincial decreases were 4,740 head in 1985, 5,500 head in 1986, 7,800 head in 1987 and 12,200 head in 1988. These decreases amount to a 2% to 5% reduction in the heifer replacement inventory.

3. Effect of ACBOP on Cow Inventories

ACBOP was found to have caused moderate increases in cow numbers. Analyzing the baseline less ACBOP scenario it was found that cow numbers would decrease slightly each year where ACBOP was in effect. These decreases ranged from 7,000 head to 1,000 head so cannot be considered significant considering the cow herd averages over 1.3 million head. This slight change in cow numbers could be misleading as cow herds are normally slow to respond, and the three year period available is insufficient to show the full impact. The change in heifer replacements is likely a more reliable guide to trends in the cow herd when such a short period is involved.

4. Effect of ACBOP on Feeder Cattle Inventories

Beginning in 1985 feeder cattle numbers would be expected to decline under a scenario without ACBOP. The decreases estimated are as follows:

Year	Reduction from Baseline	% Change from Baseline
1985	21,560 head	3
1986	18,100 head	2
1987	160,200 head	22
1988	108,700 head	14

This table does suggest the baseline employed in the analysis contains the ACBOP influence which has had an effect on feeder cattle numbers in the province.

5. Effect of ACBOP on Feeder Cattle Imports and Exports

An analysis of the effect ACBOP has had on feeder cattle imports showed that feeder cattle imports could be expected to reduce by 27 to 50% if ACBOP were removed. Without ACBOP feeder cattle imports from Saskatchewan would have decreased by 47,500 head in 1986 and 33,700 and 64,100 head in 1987 and 1988 respectively.

The influence of ACBOP on the export of feeder cattle to Ontario appears to be mixed. In two years out of the past four, i.e., 1985 to 1988, exports to Ontario displayed a decrease, in one year they remained unchanged, and in one year the exports would slightly increase without ACBOP. No set pattern was apparent in the effect ACBOP was having on feeder exports to Ontario. The average change from the baseline to the baseline less ACBOP over the four years was a 12,000 head increase in exports.

6. Influence of ACBOP on Hog Breeding Inventory

An analysis of the impact ACBOP has had on hog breeding stock inventory found that hog numbers decreased when the ACBOP influence was removed from the baseline calculations. The reductions from baseline were 4,100 in 1986, 400 in 1987 and 14,000 in 1988. The trend toward higher hog breeding numbers was slowed down substantially without ACBOP. In percentage terms the reduction from baseline to baseline less ACBOP were 2.4% in 1986, 1% in 1987 and 7.6% in 1988.

7. Conclusion

The above analysis suggests that ACBOP has had a significant impact on livestock production and has inflated the baseline. This inflation was least in cows and hogs but in hogs it did notably decrease the upward trend in breeding stock. Heifers and feeder cattle baseline numbers have the same influence causing them to be inflated. The influence in these two classes of stock is more critical as the baseline data in 1987 and 1988 are inflated by 5 and 14-22% for heifers and feeders respectively.

The consequences of this situation is that the impact of a change to a producer method of payment will be underestimated as the effect of ACBOP has already partially corrected the feedgrain price distortion, and the livestock farmers have responded by increasing their livestock numbers.

IV. COMPARISON OF NO ACBOP OFFSET WITH A CHANGE TO A PAY THE PRODUCER METHOD OF PAYMENT

In order to determine the full effect of a correction in the feedgrain price situation through a change to a producer method of payment, the following analysis was conducted. This analysis involved estimating livestock prices and inventories in a scenario where no offset is in place and comparing this situation with the situation where the method of payment is changed. This analysis will include a comparison of calf prices, heifer replacements, cow and feeder inventories and hog breeding stock inventories between the two scenarios.

In that the baseline analysis referred to throughout this study refers to the actual circumstances which existed, the scenario which is being analyzed in this section will be referred to as "base less ACBOP" as the effect of the ACBOP program has been removed. This "base less ACBOP" situation will then be compared to the producer method of payment change and reference made to the baseline versus producer method of payment findings.

A. Calf Price Effect - Base Less ACBOP Compared with a Change to a Pay the Producer Method of Payment

Calf Price ($/Cwt)

	Southern Alberta Calf Prices			Central and Northern Alberta Calf Prices		
Year	Base Less ACBOP	MOP Changed	% Change	Base Less ACBOP	MOP Changed	% Change
1985	82.09	89.68	+ 9.2	78.16	88.34	+13.0
1986	101.69	102.18	+ 0.1	96.61	98.61	+ 2.1
1987	113.90	116.28	+ 2.1	110.70	112.44	+ 2.4
1988	104.66	110.57	+ 5.6	103.30	109.29	+ 5.8

This analysis shows that the change in calf prices from base less ACBOP to a pay the producer method of payment would result in an increase in calf prices in every year throughout the province. The average increase is estimated at 3.6% in the south and 7.0% in the central and northern area. Compared to the previous analysis of baseline to method of payment change, this analysis shows that the overall increase in calf prices would average 1% and 3.6% higher in the south and north central regions, respectively. The average increase in calf prices is estimated at \$4.60/cwt compared to a change of \$2.25/cwt in the baseline vs. MOP comparisons.

B. Heifer Replacement Inventories - Base Less ACBOP Compared to a change to a Pay the Producer Method of Payment

The table below compares the heifer inventories of the base less ACBOP scenario with the situation when the method of payment is changed to a producer payment.

Heifer Replacement Inventory
(000 head)

Region	Base Less ACBOP	MOP Changed	Change
1	30.3	34.6	4.3
2	25.4	30.2	4.8
3	41.2	42.7	1.5
4	38.8	72.1	33.3
5	47.2	60.0	12.8
6	36.9	49.5	12.6
7	14.4	16.6	2.2
Province Total	234.0	305.7	71.7

This table shows that the change in heifer replacement inventories from base less ACBOP to the situation where the method of payment is changed would result in an increase in heifer inventories of an estimated 71,700 head. This increase is 4,500 head greater than the change estimated between the baseline scenario and a change to a pay the producer method of payment. This change amounts to a 6.7% change. Regions 1 and 2 show the greatest increase with a change of 10.3% and 25%, respectively.

C. Cow Inventories - Base Less ACBOP Compared to a change to a Pay the Producer Method of Payment

In an effort to determine the full impact of a change to a producer method of payment on cow inventories, Cow inventories were estimated at base less ACBOP and then compared to the inventory estimates with the changed method of payment. The following table compares these two scenarios.

Changes in Cow Inventories 1980 to 1988
(000 head)

Region	Base Less ACBOP	MOP Changed	Change
1	177	194.5	17.5
2	173	182.0	9
3	226	246.3	20.3
4	259	324.3	65.3
5	249	251.0	2
6	218	225.0	7
7	74	78.6	4.6
Province Total	1,377	1,501.7	124.7

The above analysis shows a change in average cow inventories of 124,700 head. This change, in comparison with the 10 year average change from baseline to a producer method of payment is unchanged. Considering the very slow response of the cow herd, the lack of a significant difference over the three year period since ACBOP was established, is not unexpected.

D. <u>Feeder Cattle Inventories</u> - Base Less ACBOP Compared to a change to a Pay the Producer Method of Payment

A comparison of base less ACBOP feeder cattle inventories with a change to a pay the producer method of payment is presented in the following table. In view of the rapid turnover rate of feeder cattle, approximately two times per year, one would expect a quicker response in these inventories than has been observed in the cows. Over the 1980 to 1988 time period, the analysis indicates feeder cattle inventories would have increased an average 219,000 head per year.

Average Feeder Cattle Inventories 1980 to 1988
(000 head)

Region	Base Less ACBOP	MOP Changed	Change
1	55	56	1
2	215	312	97
3	140	174	34
4	121	167	46
5	153	192	39
6	78	79	1
7	19	22	3
Province Total	782	1001	219
Average 1985-1988	669.1	976.5	307.4

In comparison the estimated increase in feeder cattle inventories is 307,400 head from 1985 to 1988. This, over the 1985 to 1988 period, compares with a change of 230,300 head from baseline (746,000 head) to method of payment (977,000 head) over the same period. This analysis shows a 45% increase compared to a 31% change from the baseline to a producer method of payment analysis.

E Feeder Cattle Imports and Exports - Base Less ACBOP Compared to a change to a Pay the Producer Method of Payment

It is estimated that the difference in the number of feeder cattle imported from Saskatchewan would have been 48,400 head greater with a change to a producer method of payment when compared to the scenario where the ACBOP program was not in effect. This is an increase in imports of 31,600 head when compared to the difference between baseline and a producer method of payment change.

The analysis on the difference in the export of feeder cattle to Ontario at a base less ACBOP compared to a pay the producer scenario shows varied response. In two years out of the past four, exports to to Ontario would decrease on average of 10,000 head and in two years there would have been an increase of 26,000 head on average. In one year there was no change. This analysis appears to display the sensitivity of the level of the ACBOP and the relative feedgrain prices between Ontario and Alberta. No conclusive comment can be made regarding the feeder cattle export situations after a change to a pay the producer method of payment.

F. Slaughter Cattle Exports - Base Less ACBOP Compared to a Change to a Pay the Producer Method of Payment

The analysis suggests that slaughter cattle exports would, without the ACBOP or a change a producer method of payment, have been substantially less. On average over the past three years, exports would have averaged 138,000 head compared to 149,000 with a change to a producer method of payment or the ACBOP program.

G. Hog Breeding Stock Inventories - Base Less ACBOP Compared to a change to a Pay the Producer Method of Payment

On analysing the change from the base less ACBOP scenario to a change to a producer method of payment, it is apparent that since 1985 hog production would have increased. In the following table, the 3 scenarios are combined, i.e., Base Less ACBOP Baseline (which includes ACBOP) and a change to a producer method of payment.

Breeding Hog Inventory - Provincial Total
('000 head)

Year	Base Less ACBOP	Baseline (With ACBOP)	MOP Changed
1985	162.0	159.8	166.6
1986	164.9	169.0	167.3
1987	169.5	169.9	169.8
1988	178.4	192.0	178.0

These data show that the ACBOP program has already made the corrections in hog breeding stock numbers, so little change can be expected from a change in the MOP.

V. CHANGES IN THE WELFARE OF GRAIN CONSUMERS FOLLOWING A CHANGE TO A PAY THE PRODUCER METHOD OF PAYMENT

The concept of consumer surplus or consumer welfare involves the determination of the benefits consumers derive when grain is purchased at various market prices. It involves calculations to determine the benefits grain purchasers receive as they purchase grain at various prices. An example would be if farmers purchased feed barley at $120/T during one period and then later purchased the same grain for $80/T it would be estimated that the grain consumers realized $40/T (120-80) when grain was purchased at the lower price. In the context of this study it is anticipated that after a change to a producer method of payment, livestock feeders will purchase their feed barley supplies at a price which is lower than the prices which currently prevail. This reduction in the price of local sales of feed grain is considered to be a benefit grain consumers receive as a result of a change to a producer method of payment. This benefit is defined as a change in the welfare of grain consumers or a "change in consumer welfare". It is comparable to the producer welfare determination previously discussed. The producer welfare calculations determined the change in the welfare of grain producers after a change to a producer method of payment and the accompanying reduction in grain prices. The consumer welfare calculations determine the change in the welfare of grain consumers after a change to a producer method of payment and the accompanying reduction in the local off-Board price of barley.

The reduction in the local feed barley price after a change to a pay the producer method of payment compared to the current price was displayed earlier as the feed grain price distortion. As only the price of local sales to livestock feeders will be effected by the reduction in prices after a change to a producer method of payment, the change in consumer welfare will be restricted to the quantity of grain fed within the province times the change in price. The calculation of consumer welfare thus involves the quantity of grain fed locally times the appropriate price distortion. This computation will show what benefits the consumers of grain will receive after a change to a producer method of payment. The table below displays the change in consumer surplus after a change to a producer method of payment.

CHANGE IN CONSUMER WELFARE
($'000)

Year	Region						
	1	2	3	4	5	6	7
1978	57.6	309.2	142.6	388.4	59.6	178.9	51.9
1979	1491.8	4533.0	3228.4	4230.2	4704.9	2535.0	583.4
1980	3209.3	11163.8	7690.7	5312.5	9429.7	5234.7	1373.5
1981	790.4	7784.6	1498.7	2842.1	4606.1	3131.7	537.5
1982	957.5	3996.2	1635.0	3081.3	4840.0	2955.0	984.9
1983	1380.2	5606.5	2579.7	2224.4	4370.0	2496.3	591.9
1984	2411.9	8756.8	3324.5	4080.2	7543.8	4165.8	1210.3
1985	4026.5	16465.5	7796.3	6584.4	11794.4	6530.6	1505.8
1986	957.0	4525.7	2882.1	2640.4	4543.7	3231.0	691.6
1987	1210.4	3746.2	1857.7	4698.4	5540.7	4239.1	854.3
1988	2089.4	8768.2	3077.5	4434.7	7208.3	4702.5	804.1
AVERAGE	1689	6878	3247	3683	5876	3582	835

It is apparent that in response to the lower barley price, the consumer surplus or consumer welfare increased in every region of the province. The greatest increase was in Region 2 with an average increase of $6.9 million, Region 5 was second highest with an increase in the consumer welfare of $5.9 million. Regions 3, 4 and 6 displayed changes ranging from $3.2 to $3.7 million. Regions 1 and 7 show the least change with increases of $1.7 and $0.8 respectively.

VI. CHANGES IN GROSS REVENUE TO THE FEEDLOT AND COW/CALF SECTORS

Following the change to a producer method of payment, it is anticipated that gross revenues to both the cow/calf and feedlot sectors will increase. The following table depicts the changes in gross revenue for the cow/calf and feedlot sector:

Change in Gross Revenue for Livestock Sector

(1980 - 1988)

(millions of dollars)

	COW/CALF SECTOR GROSS REVENUE (MILLIONS OF DOLLARS)			FEEDER CATTLE INVENTORY GROSS REVENUE (MILLIONS OF DOLLARS)		
YEAR	BASE LESS ACBOP	MOP	CHANGE	BASE LESS ACBOP	MOP	CHANGE
1980	643	667	24	1167	1398	230
1981	496	508	12	1422	1449	28
1982	540	592	52	1374	1627	253
1983	554	627	73	1185	1392	206
1984	527	630	103	1215	1587	372
1985	520	640	120	1097	1502	405
1986	638	734	96	929	1269	340
1987	722	846	124	928	1683	755
1988	668	819	151	1025	1386	362
AVERAGE	582	670	88	1149	1479	330

Note: Cow/calf calculation based on the price of a 525 pound weaned calf adjusted for a 90% calf crop. Feeder calculation based on the price of a 1100 pound slaughter steer times feeder inventory July 1 adjusted for the average feedlot turnover rate of 1.7.

The above table indicates the cow/calf sector could anticipate an increase in gross revenue of 88 million dollars on average over the period 1980 to 1988. The increase in gross revenue over the last five years of the simulation period is generally over 100 million dollars. The table also indicates the feedlot sector could anticipate an increase in gross revenue, on average, of 330 million dollars. Given the cost savings per tonne from a change in MOP, the benefit to the feedlot sector would be even higher.

VII. TOTAL WELFARE CHANGES FROM A CHANGE IN THE MOP

The change in the welfare of agriculture in a region is a combination of the change in the producer welfare plus the change in consumer welfare. The following table combines the change in producer welfare with the change in consumer welfare. The producer welfare reflects the welfare of grain producers whereas the consumer welfare reflects the livestock feeders welfare.

CHANGE IN NET WELFARE

Average 1978 - 1988 ($'000)

	1	2	3	4	5	6	7	Province
nge in ducer plus	- 14463	- 23391	- 6237	- 8093	- 34219	- 9324	+ 2978	
nge in sumer plus	+ 1689	+ 6878	+ 3247	+ 3683	+ 5876	+ 3582	+ 835	25790
Change Welfare	- 12774	- 16513	- 2990	- 4410	- 28343	- 5742	+ 3813	
ange in oss venue of ain oducers	+ 2007	+ 16256	+ 37505	+ 6763	- 16582	- 9057	+ 17293	+ 54385
Change Revenue Feed Costs	3696	23134	40752	10646	- 10706	- 5475	18128	80175

cludes the Crow Benefit Payment.

. Producer surplus is calculated for all crops, whereas consumer surplus is only calculated for barley. Therefore, the net welfare changes include only changes to barley producers and consumers and changes to wheat and canola producers. If consumer surplus for wheat and canola were included in the net welfare calculations, this could result in a net welfare gain to the combined livestock and grain sector in Alberta.

The above table shows that with a change to a producer method of payment without a Crow Benefit Payment the change in the welfare of farmers in the various regions would have varied from a decrease of $28.3 million to an increase of $3.8 million. The average decrease for the province was $9.6 million.

In order to bring the Crow Benefit into consideration, the table also displays the average change in gross revenue of grain producers. For the province in total an increase of $54.4 million.

In summation the gross revenue of grain producers across the province is expected to increase by $54.4 million and the feed cost of livestock producers is expected to decrease by $25.8 million. This amounts to an initial increase in the benefit to Alberta farmers of $80.2 million.

VIII. THE CROW BENEFIT PAYMENT

The accuracy of many of the formulas derived to explain the changes which have occurred in the production of grains in the various regions was increased significantly when a factor was included which reflected the amount of the Crow Benefit payments or previous to 1983, the crow gap. The analysis found that when the actual per tonne amount of the crow gap and Crow Benefit (labelled GTRAN for Government transportation) was included in the various formulas, the accuracy of the estimate derived by the formulas increased to a level where in many cases over 90% of the variance in the actual production of the grain was being explained by the predictors. A concern was that this Crow Benefit factor may be reflecting an overall trend in production. This was tested in every region and with every crop which included GTRAN. The results of this test was that GTRAN and trend were partially reflecting the same factor in only Canola production in Regions 1 and 3. The GTRAN variable was removed from the Canola production formula in Region 1 but was retained in Region 3 due to multicollinearity problems with a trend variable. In all other regions and with all other crops in which it is included GTRAN is an independent variable which is significantly related to the production of that crop. GTRAN is included in 18 of the 22 crop production equations employed in the simulation.

An analysis of the GTRAN variable found that the elasticity of GTRAN varies from 0.31 to 3.04 with an average of 0.95 for the various crops and

regions. There appears to be a difference in the GTRAN elasticity depending on the crop. GTRAN elasticities associated with wheat production averaged 1.2 when the very high elasticity for wheat in Region 3 (3.04) was included and 0.85 when it was excluded. The elasticity of 3.04 is higher than would be expected but after a multitude of tests with other variables GTRAN still remained the independent variable which added a significant element to the explanation of wheat production in region 3. The elasticities for GTRAN in relation to barley production averaged 1.11 and for Canola averaged 0.38. Such a difference would be anticipated when the proportion the Crow Benefit or Crow Gap is of the market price of the 3 grains is considered. The Crow Benefit would in relationship to the price of barley be highest, second in relation to the wheat price and lowest in relation to the price of Canola.

Comparing the price and cross price elasticity to the GTRAN elasticity it was found that the average of the price and cross price elasticities for wheat was 0.75 compared to 0.85 for GTRAN, barley 0.58 compared to 1.11 for GTRAN and 1.32 compared to a GTRAN elasticity of 0.38 for Canola.

An extensive search of the literature was conducted in an effort to find previous estimates of supply elasticities related to a long term and anticipated subsidy. To date we have been unable to attain long run supply elasticity estimates relating to a crop subsidy from the literature.

For those researchers, who in the future, are interested in further research regarding the effect of long term subsidization on crop production, we have included the actual point elasticities in the appendices.

IX. SUMMARY OF RESULTS

A. Deriving the Estimates

This analysis relies on the accuracy of the econometric equations derived from the actual data for the production and price estimates. These equations in almost all instances attained a statistical significance sufficiently high that the probability of a chance relationship is less than 5% and in most instances less than 1%, i.e., the accuracy and reliability attained would suggest that the reader may interpret the results as being reliable 95 to 99 times out of 100.

The equations themselves have been formulated in a manner which reflects both the tendency of farmers, how they would plan to respond to changes in the price of their products, and restrictions which exist preventing them from always fulfilling those plans.

The disease situation which has become prevalent in canola is a prime example. At times of very high canola prices and relatively low prices with other crops, one could expect farmers to increase canola production without restraint. In actuality, farmers are not free to make such expansions as the diseases of canola are forcing farmers to wait at least one year and most times two or three years before they plant canola in the same field as it was previously seeded. The canola production equations in Regions 3, 5 and 6 in particular display this constraint, with the previous year's canola

production having a negative relationship to the current years production.

The relationship between wheat and the previous year's summerfallow display the complementary relationship one would expect as most farmers, especially in southern Alberta and the Peace River, seed their wheat into land which was fallowed in the previous year. The wheat equations derived for Regions 1, 2 and 7 all include the previous year's fallow acres as a factor which directly influences the production of wheat.

A further observation regarding the crop equation is the substitutability of barley and canola throughout the province and barley, canola and wheat in central Alberta. A review of the canola and barley equations display the substitutability or complementarity of these two crops. In all regions except Region 6 the barley production equations include a canola function. In the canola equations the inclusion of either a wheat or barley function appears to be a reflection of the interrelationship between the crops.

It thus appears that the equations derived and employed in this analysis do accurately reflect the factors which influence the production of crops in the various regions.

In spite of this high degree of accuracy in the crop production equations and the accompanying results, barley in Region 3 and canola

in Regions 5 and 7 are areas of concern. The barley equation in Region 3 has no apparent weakness, but the anticipated increase in barley production would strain the flexibility of farmers and the resources, although they are not outside the realm of possibility. The concern regarding canola in Region 5 was that canola production in this region failed to show any significant relationship to the price of canola or any of the other three crops. Historically this area has shown very large changes over the years such as a 90,000 acre increase, or 37%, between 1982 and 1983. Between 1980 and 1981 a change of comparable magnitude occurred but this change was a 97,000 acre decrease in the area seeded to canola. The analysis was unable to detect any change in canola production which could be reliably anticipated in response to a change to a producer method of payment in this region.

The estimates of canola response in Region 7 was another area in which some caution is advised. The canola production equation appears reasonable and passed the appropriate statistical tests, but the estimated increase in canola production is greater than previously experienced in this region.

With these cautions and concerns in mind the impact committee feels that the results presented herein are accurate in direction but may, with barley in Region 3 and canola in Region 7, overestimate the response which would actually occur.

The technique employed in this analysis is one of the most accurate and sophisticated approaches developed by economists, but like the latest rotary combine it is not perfect as some grain still goes over the sieves.

The off-Board grain price, livestock price and livestock inventory charges appear to be accurate. The anticipated response in three areas may, however, appear different from expectations. The barley price distortion is one such area. It has been claimed that the price distortion is equivalent to the payment the railways receive from the federal government. The price distortion reported in this analysis reflects both the payment to the railway and the full dynamics of the marketplace as it adjusts to this distortion. The interpretation of the distortion is that the initial shock of the railway payment is equal to the full payment, but as the grain producers and feed users adjust, the amount of the distortion influencing the market varies with the final influence being those reported in this study.

In the area of livestock production the response in two areas appear to be larger than expected. These areas are feeder cattle inventories in Region 2 and cow inventories in Region 4. In both instances, the response of farmers in the area appear both possible and feasible.

B. Results and Discussion

1. Crop Production

The analysis of crop production, through the application of the simulation model, suggests that crop production would have changed in all regions in response to a change to a producer method of payment and a reduction in the price of grain at the elevator. Wheat production would have increased in southern Alberta, but decreased in all other regions. In aggregate for the province a decrease in wheat production of 110,000T or 4.2% would be expected. Barley production expected to increase in Regions 1 and 3, but decrease in all other regions. The net change for the province is estimated at a 2% increase. If the barley response in Region 3 is 20% less than estimated, the response for the province as a whole would reduce to a 1% increase. The estimate regarding canola production is that production would have increased in all regions except Region 5 where no change occurred, and Region 6 which, although the response is mixed over the years, showed a slight decrease. The increase in production for the province as a whole was estimated at 17.5% of current production. If the farmers in Region 7 did not respond to the extent estimated, but instead increased production to only 80% of the estimate, the province as a whole would realize a 13.7% increase instead of the 17.5% originally estimated.

The analysis of oat production was restricted to Region 5 where the production of oats is significant relative to the other crops. The analysis shows a mixed response with increases more numerous and of a greater volume than the decreases. It can be concluded that oat production is very sensitive to a change to a producer method of payment and it appears that over all an increase would have been expected.

2. Livestock Production and Prices

The interface between the grain and livestock industry is through feedgrains. The analysis of the feed barley price distortion is a most significant and critical evaluation of the grain/livestock interface. The grain price distortion is represented by feed barley prices in this study. The analysis found that barley prices were inflated by between \$7.10 and \$23.79 per tonne over the past eleven years. The average distortion is estimated at \$12.47. The impact of this finding is that if a producer method of payment were changed, the price of barley for local off-Board sales would, on average, decrease by \$12.47. This reduction in price of feed barley would then reduce the cost of feed to the livestock feeder and in turn the livestock industry would be expected to respond. The analysis supported this contention.

The first analysis conducted was to compare the effect a change to a producer method of payment would have in relation to the current

situation where the railways are paid the Crow Benefit and the distortion is being offset by the Alberta Crow Benefit Offset Program, ACBOP. A second analysis was then conducted to determine the overall impact of a change to a producer method of payment by comparing a scenario where the railways were receiving the Crow Benefit payments without an offset program in place to a change to a producer method of payment.

On comparing the livestock situation for the past ten years including the ACBOP program to a change to a producer method of payment it was found that calf prices would increase approximately $2.25/cwt with a change to a pay the producer method of payment. The test did, however, show that calf prices would have been lower in 1986 and 1987 as the distortion in these years was less than the ACBOP payment. Cattle feeders appear to have bid a good portion of the ACBOP payment into the price of calves. Heavy feeder cattle prices displayed much the same response as the calves, where prior to 1985 and the ACBOP program feeder prices would increase by 5.2% or $3.80 on average with a change to a pay the producer method of payment. During the ACBOP period, the feeder price would have been $2 to $3 lower with a change to a producer method of payment.

In response to the change in calf and feeder prices an increase in heifer replacement would occur. This increase begins slowly, but

over the ten year period increases to the point where in 1988 the inventory of heifer replacements is 158,000 head greater than the current situation, even with ACBOP in effect. Over the period studied the average annual change in heifer inventories from current to a change to a producer method of payment would average 67,200 head. Along with the change in heifer inventory the cow inventories also increase. The change in cow inventory numbers is of a lower percentage than heifers, but of near equal magnitude in most years. Over the entire period, cow inventories increase an average of 125,000 head (12%), with a large portion of this increase occurring in Regions 3 and 4.

The study included an evaluation of the effects a change to a producer method of payment would have had on feeder cattle inventories, imports and exports. Inventories of feeder cattle are expected to increase after a change to a producer method of payment. The increase is estimated at 185,000 head (23%) with large increases occurring in Regions 2, 3, 4 and 5. The increase in Region 2 is very large at an estimated 76,000 head. Cattle feeders in this region feel that such an increase is possible.

Changes in the import of feeder cattle from Saskatchewan were also identified during the study. The study estimates that an increase of approximately 15,000 head in feeder cattle imports would have occurred with a change to a producer method of payment, representing a 9% change from the actual. No pattern was identified with feeder

cattle exports over the entire period. It does appear that the producer method of payment would reduce feeder cattle exports less than what occurred during the period with the ACBOP program.

The analysis of the effect a change to a producer method of payment would have had on slaughter cattle exports to the United States shows that exports would have remained virtually unchanged with a change to a producer method of payment. Both the current ACBOP program and a change to a producer method of payment resulted in the same flow of slaughter cattle to export markets, an average of 150,000 head per year.

The analysis of hog breeding stock inventories suggests that prior to 1985 hog numbers would have increased 5 - 10% (4,000 to 6,000 head). Compared to the period in which the ACBOP program was in effect, a change to a producer payment would be expected to have resulted in a 1 - 2% decrease in hog breeding inventories.

The Hall committee, based on Agriculture Canada's Forecasting model of a producer method of payment, forecast a 19% increase in beef output (steer and heifer slaughter) and a 14% increase in pork output in western Canada. Rosaasen and Schmitz (1985) indicate that some studies contend western livestock feeding could increase by upwards of 30%. In their review of previous work, they show MacEcheran (1978) estimated a 21% increase in cattle production, while Harvey (1980) indicated a 30% increase in the beef cow herd and a 20%

increase in steer and heifer slaughter in western Canada. In all the studies cited above, the authors indicate the livestock response in Alberta to be above the reported mean for western Canada. The results of this study are of the same direction and similar magnitude as previous research on the Crow issue.

3. The Effect of the Alberta Crow Benefit Offset Program (ACBOP)

In order to determine the full effect of a correction in feedgrain prices, an analysis was made of livestock prices and inventories in a scenario where no offset, such as ACBOP, is in effect, and comparing these results to the situation where the producer method of payment is changed.

The analysis of calf price changes between these two scenarios suggests that on average calf prices would increase by approximately \$4.60/cwt compared to a change of \$2.25 in the original baseline versus a pay the producer method of payment comparison.

The increase in cow, feeder cattle and hog breeding stock inventories are also expected to be greater as a result of a change to a producer method of payment, than under the scenario with no offset in place. Over the period 1985 to 1988, the estimated increase in feeder cattle inventories is 307,000 head when the ACBOP effect is removed, compared to a 230,000 head increase when the baseline with ACBOP is compared to a change to a producer method of payment. Hog breeding stock inventories are also expected to

increase greater when a no ACBOP scenario is compared to a change to a producer method of payment. The extent of this increase is small, averaging 1%. An evaluation of cow inventories found that up until 1988, ACBOP had only a moderate effect, less than 1%. This suggests the changes in cows and hogs from no ACBOP to a producer method of payment would be similar to those from the current situation with ACBOP to a producer method of payment.

Feeder cattle imports and the export of slaughter cattle were estimated to be much less without the ACBOP program. This in turn means the difference between the scenario where no offset is in effect compared to the scenario where the producer method of payment is changed will be greater than the change anticipated between the baseline with ACBOP and a change to a producer method of payment.

It is estimated that feeder cattle imports would have increased 48,000 head per year with a change to a producer method of payment compared to the scenario where no offset program was in effect. This is an increase in imports of 31,600 head per year when compared to the difference between the baseline with ACBOP and a change to a producer method of payment.

The analysis of feeder cattle exports to Ontario was mixed with both increases and decreases in exports over the period from 1985 to 1988 when the scenario without ACBOP is compared to a change to a producer method of payment. No trend or pattern was apparent. The

only conclusion suggested is that feeder cattle exports to Ontario are influenced by factors other than a producer method of payment.

It is estimated that slaughter cattle exports to the U.S. would, without the ACBOP or a change to a producer method of payment, have been substantially less than experienced. On average, over the past three years, exports would have averaged 138,000 head, compared to 149,000 head with a change to a producer method of payment or the ACBOP program.

4. Welfare and Gross Revenue Changes

In order to estimate the changes which would occur in the welfare of grain and livestock farmers, three tests were conducted. These tests included deriving the change which would occur in the grain farmer's returns above variable costs, changes in the gross revenue of grain farmers, and the changes which would occur in the cost of feedgrains purchased by local livestock feeders.

a. Grains.

The analysis found that with the anticipated reduction in the price of grains at the elevator, farmers' returns above their variable costs of production would have declined as a result of a change to a producer method of payment unless they receive a Crow Benefit payment. The decrease for the province is estimated at 8.5% with decreases ranging from 19% and 16% in Regions 5 and 6, to 2% and 3% in Regions 7 and 4 respectively.

When the Crow Benefit payment is included, the gross revenue of grain producers in all regions, except 5 and 6, increase. These increases in gross revenue vary from $6.9 million in Region 4 to $37.5 million in Region 3, the average increase estimated at $17.6 million. The two regions which displayed decreases, Regions 5 and 6, had gross revenue decreases of $16 million and $9.1 million respectively as a result of a change in the MOP. For the province as a whole the average change over the years studied was a $54.4 million increase, an increase of 4% in the gross revenue of grain farmers.

b. Livestock.

A change in the welfare (consumer surplus) and gross revenue of local livestock feeders was also anticipated as a result of a change to a producer method of payment. This change would be as a result of a decrease in grain prices. The analysis found that the reduction in feedgrain prices would have increased the welfare of livestock feeders by $26 million annually. This increase in the welfare of livestock feeders varied from $7 million in Region 2 to $835,000 in Region 7. Part of the cost savings to feedlots is expected to be passed on to cow/calf producers in the form of higher calf prices. Through the higher calf prices and the accompanying increase in the cow herd, the provincial annual gross revenue to cow/calf producers would be expected to have increased by $88 million. This increase is small in the earlier years as cattlemen build up their herds. The last five years, 1984 to 1988, shows annual increases over $100 million to cow/calf producers.

The increase in feeder numbers comes about via lower feed costs, more calves available for feeding, as well as increases in feeder imports. The analysis indicates an increase in annual gross revenues, from a change in method of payment, of $330 million for the feedlot sector.

In summation, the gross revenue of grain producers across the province is expected to increase by $54 million and the feed costs of livestock producers is expected to decrease by $26 million. The analysis indicates an increase in the annual gross revenue of the cow/calf and feedlot sectors of a total of $330 million.

c. Conclusion

Following a decrease in grain prices due to a change to a pay the producer method of payment, the model showed that for the period 1978-1988 the gross revenue of grain producers across the province would have increased by $54 million and the feed costs of livestock producers would have decreased by $28.1 million. There were regional differences in impacts. It is estimated that the response in the livestock industry would have resulted in an increase in gross revenue of $330 million from the sale of cattle, and $10 million from the sale of hogs on average over the years studied.

X. IMPACT OF A CHANGE TO A PRODUCER METHOD OF PAYMENT ON PROCESSORS

In conjunction with the on-farm analysis, the Impact Committee undertook to have a brief look at the impact a change to a producer method of payment would have on processors. This was a cursory evaluation in that only one firm was interviewed in each industrial segment. The intent of the interviews was to be able to report a general feeling or tendency industry participants have regarding the change in the MOP. The individuals interviewed were involved in the following industries: malting, feed manufacturing, brewing, alfalfa processing, brewing and distilling. The impressions, judgements and preference with respect to a change to a producer method of payment follow.

Maltsters

The malting industry purchases its barley supplies from the Canadian Wheat Board. The CWB sets the price for malting barley in relationship to their asking export price. The normal procedure in buying malting barley begins with the farmer delivering a sample of the barley to the elevator. The elevator agent does an initial grading and then forwards the sample to the maltster. The maltster evaluates the sample and reports back to the elevator as to the acceptance or rejection of the grain. If the grain is accepted, the farmer is asked to deliver it to the elevator where a further sample is taken and forwarded to the maltster. Upon acceptance of this final sample, the grain is forwarded by the elevator agent to the malting plant either by truck or rail at domestic rates. The farmer upon

delivery of the grain to the elevator is charged the producer share of the WGTA. The maltster in turn is refunded the domestic rail rate minus a stop off charge, if the malt is exported. The screenings removed from the grain prior to processing are sold on the local feed market.

Through a change to a producer method of payment, it is recognized that the returns to the farmer at the elevator will reduce, but it is uncertain whether or not this reduction will be passed on to the maltster. This is of consequence particularly with local sales of both malt and screenings. The value of screenings is expected to decrease in response to a decrease in feed grain prices. If there is no correction in the CWB malt barley price, the maltster would incur a loss in revenue.

The malting industry in Alberta exports 50% of its production. The remainder is sold to brewers within the province. The farmers are currently deducted the freight cost to Vancouver; the maltsters anticipate that this same condition of trade will continue regardless of the method of payment employed.

The maltsters expressed concern that after a change to a producer method of payment their industry may lose a portion of their control of barley quality. It is anticipated that when farmers pay the full freight costs to Vancouver, they will insist on trucking their grain directly to the malting plant and not to the local elevator. The elevator agent currently performs a quality control function for the maltster preventing off quality grain being shipped to the malting plant. If the grain is trucked

directly to the malting plant this stage of quality control is lost. Maintaining this control is of major importance to the maltster.

In that both malt and the barley receive the WGTA rate, a change to a producer method of payment is not expected to have a significant impact on the proportion of barley processed in the province compared to barley exports.

In general, the maltsters are comfortable with the current method of payment and may wish to be excluded from a change to a producer method of payment of the Crow Benefit.

Feed Manufacturers

Alberta's feed manufacturers today employ the Alberta Crow Benefit Offset (ACBOP) certificate when purchasing grain and receive certificates when they sell feed to a customer. As a result of this program, they estimate that the majority of developments which would occur from a change to a producer method of payment have already occurred under the ACBOP program.

Under the ACBOP program, they have not experienced a change in the buying or selling price of their products. The cost to the farmer changed, but the market price appeared to be unaffected. With a change to a producer method of payment they would anticipate a drop in the price of grains and screenings. Because ACBOP has already reduced the relative cash flows of

firms in this industry, a change to a producer method of payment is not expected to improve the cash flows of the business.

The change which is anticipated after a change to a pay the producer method of payment is a saving in time and labour filling in the various ACBOP forms, and a possible increase in the sale of prepared feeds as the price of the grain component declines.

A change to a pay the producer method of payment, coupled with the Canada/U.S. Free Trade Agreement is expected to open Alberta's livestock industry to competition with the U.S. Whether or not our poultry industry can compete is questionable, but our pork and beef industries will be competitive. It is anticipated that meat marketing patterns will change from an eastern flow to a north, south flow into the western states. The need for a feed manufacturer and livestock feeder to be competitive in view of these changes is critical if they are to continue to develop and expand.

<u>Alfalfa Processors</u>

The alfalfa processors anticipate a change to a pay the producer method of payment could have a major impact on their industry, depending on who receives the Crow Benefit payment, the processor or the land owner. Farmers are currently paid approximately $27/ nne for the alfalfa harvested from their land. If the pay the producer method of payment were changed in such a manner that the land owner were paid and the processor

in turn was responsible for the full freight rate to the coast, the alfalfa buying price on the farm would drop into the \$4-\$7/T range. At this price it is doubtful if farmers would grow the alfalfa.

The most common practice regarding the acquisition of alfalfa by a processor is for the processor to contract his supplies from the farmer. The farmer seeds the crop following the recommendations of the processor, the processor then takes on the responsibility for harvesting and transporting the crop to the plant. The processor in effect manages the crop following seeding.

Considering the level of participation the processor has in the growing, harvesting, transporting and marketing of the crop, it seems reasonable that the processor could be considered the farmer in the case of alfalfa and receive the Crow Benefit payment under the Alberta/B.C. pay the producer method of payment.

Alfalfa products currently receiving Crow Benefit payments include dehydrated alfalfa pellets, meal and cubes, and double compressed hay bales. The hay bales are not named in the WGTA, but the railways are currently receiving Crow Benefit payments on this product. The majority of the alfalfa is exported, large quantities going to the west coast U.S. and Japan. The current mode of transportation employed for processed shipments is rail. The processors mentioned that with a change to a pay the producer method of payment and if they were to receive the funds directly, they would likely make greater use of trucks.

The alfalfa dehydrators feel their industry could not survive a change to a producer method of payment unless they receive the Crow Benefit payment directly. Paying the Crow Benefit funds to the land owner, and leaving the processor to pay the full transportation costs would, they feel, bankrupt their industry. They would though support a change to a producer method of payment if the processor were deemed to be the farmer and received the Crow Benefit payment directly. The industry generally reflects the opinion that without some form of subsidization such as the Crow Benefit, they would be unable to continue in business.

Distillers

The Alberta distillers interviewed managed an operation which only processed off-Board grains. These grains are purchased at Alberta Wheat Pool street prices on the local market. The supplies are then trucked to the plant for processing. By-products and screenings are sold throughout Alberta, B.C. and into the North Western U.S.A. Approximately 80% of the final product is sold on export markets with 25% of these shipments going off-shore. Twenty percent of the products are sold in the domestic market.

The distillers felt that a change to a producer method of payment, if it was associated with a decrease in their price paid for grain, would be a significant benefit to their industry. They perceived that the greatest benefit would be in export markets where 24 cents per litre often makes the difference in whether or not a sale is made. It was estimated that

with a change to a producer method of payment, and the improved competitiveness of Alberta distillers, the overall sale of products could increase by 50%.

The distiller currently purchases grain from all three prairie provinces, so would need some form of compensation for purchases from outside Alberta. This was recognized as an administrative detail, but of major importance to a distiller if market disruptions are to be prevented. The change which would occur in the price of by-products was recognized, but the distiller felt that an expanding livestock industry would provide ready markets for the by-products.

In summation, the distillers were in favour of a change to a pay the producer method of payment. Any decrease in the price of by-products was thought to be more than offset by the increased competitiveness internationally, especially against the larger eastern Canadian and U.S. distillers.

Brewers

The Brewer interviewed purchased his malting supplies locally and marketed the products both domestically and in export markets. It was particularly noted than an effort is made to retain a presence in U.S. markets, although due to the limited ability to compete, sales into the U.S. are small. The ability to compete is apparently limited by the lack of economies in the size of the Alberta operations and the price of

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APPENDICES

APPENDIX A

APPENDIX A

AGRICULTURAL REPORTING AREAS

APPENDIX B

APPENDIX B

List of Variables - GRAINS MODEL

NAME	DESCRIPTION
NINTW	Net initial payment for wheat. This variable represents the initial payment minus transportation charges to Vancouver. Unit of measurement is $/tonne.
CANST	Provincial on farm canola stocks, '000 of bushels.
BARST	Provincial on farm barley stocks in '000 of tonnes.
WPRO	Wheat Production in '000 Bu. (Dependent Variable)
LPROW	Lagged Wheat Production, one period, '000 Bu.
NINTB	Net initial payment for barley. This variable represents the initial payment minus transportation charges to Vancouver. Unit of measurement is $/tonne.
SUMF	Summerfallow acres lagged one production period. Unit of measurement is '000 Ac.
YEAR	Time variable to take account of technology changes over the period, measurement is in years.
NCSPR	U.G.G. canola March cash price ($/tonne).
BPRO	Barley production in '000 Bu. (Dependent Variable)
CPRO	Canola production in '000 Bu. (Dependent Variable)
LCPRO	Lagged canola production one period, '000 Bu.
RNFALL	Rainfall in a particular region in millimetres.
INTBRD	Initial payment for barley minus transportation from Red Deer to Vancouver, $/tonne. This variable changed when new initials are announced.
LSU	Logged Canadian Stocks - use ratio.
ADJ	Adjustment Payments, $/tonne. This variable was included when announced and took on a value of zero when the new initials were announced.

NAME	DESCRIPTION
LAGRD1	Lagged one month A.G.C. price in Red Deer, \$/tonne.
INTBGP	Initial payment for barley minus transportation from Grande Prairie to Vancouver, \$/tonne.
INTMED	Initial payment for barley minus transportation from Medicine Hat to Vancouver, \$/tonne.
LAGGRP	Lagged one month, A.G.C. price in Grande Prairie, \$/tonne.
LAGMH	Lagged one month, A.G.C. price in Medicine Hat, \$/tonne.
INTBLE	Initial price for barley minus transporation from Lethbridge to Vancouver, \$/tonne.
LAGLE	Lagged one month, A.G.C. price in Lethbridge, \$/tonne.
INTBCA	Initial payment for barley minus transportation from Calgary to Vancouver, \$/tonne.
LAGCAL	Lagged one month, A.G.C. price in Calgary, \$/tonne.
INTBVER	Initial payment for barley minus transporation from Vermilion to Vancouver, \$/tonne.
LAGVER	Lagged one month, A.G.C. price in Vermilion, \$/tonne.
INTED	Initial payment for barley minus transportation from Edmonton to Vancouver, \$/tonne.
LAGEDM	Lagged one month, A.G.C. price in Edmonton, \$/tonne.
RAT(B/C)	Price Ratio, $\frac{\text{Barley (Initial -- Transportation)}}{\text{Canola (Price -- Transportation)}}$
RAT(W/C)	Price Ratio, $\frac{\text{Wheat (Initial minus Transportation)}}{\text{Canola (Price minus Transportation)}}$

NAME	DESCRIPTION
OAC	Oats acres lagged one production period, '000 Ac.
DUMV	Dummy Variable to represent the change in new canola variables during 1978.
BAC	Barley Acres. This variable is lagged one production period, '000 Ac.
DUMPL	Dummy Variable to represent crushing plant that was set up in the Peace River Region during 1978.
GTRAN	Government share of total rail transportation cost to Vancouver in $/tonne.

N.B. All initials in price functions included a deduction for dockage and elevator handling charges.

LIST OF VARIABLES -- LIVESTOCK MODEL

Note: With the exception of calf price (RPS4, RPN4) and dummy variables, any number appearing at the end of a variable denotes the region from which the variable was derived. As well, an "L" appearing at the beginning of a variable denotes a one period lag with an "L2" being a two period lag and so forth.

Name	Description
CI	Beef cow inventory on farms July 1st in '000 of head, 1979-1988.
HI	Heifer replacement inventory on farms July 1st in '000 of head, 1979-1988.
CIHI	Beef cow and heifer inventory on farms July 1st in '000 of head, 1979-1988.
FDR	Feeder steer and heifer inventory on farms July 1st in '000 of head, 1979-1988.
HOG	Hog breeding stock inventory on farms July 1st in '000 of head, 1978-1988.
EXPONT	Feeder cattle and calves exported annually to Ontario in #'s of head, 1979-1988.
SKEXP	Annual import of feeders from Saskatchewan in #'s of head, 1979-1988.
SLEXP	Quarterly exports of live slaughter cattle to the United States in #'s of head, 1984-1988.
CWT	Quarterly hot carcass weight of all cattle slaughtered in Alberta in pounds per head, 1979-1988.
RPSL	Quarterly southern Alberta calf price in $/hundred pounds live weight, 1978-1988. Price for regions 1, 2 and 3.
RPNL	Quarterly central and northern Alberta calf price in $/hundred pounds live weight, 1978-1988. Price for regions 4, 5, 6 and 7.
RPSH	Quarterly southern Alberta heavy feeder price in $/hundred pounds live weight, 1978-1988.

Name	Description
RPNH	Quarterly central and northern Alberta heavy feeder price in $/hundred pounds live weight, 1978-1988.
RPN4	Lagged one year fourth quarter calf price for central and northern Alberta.
RPS4	Lagged one year fourth quarter calf price for southern Alberta.
RPW	Calf price divided by net initial for wheat.
RPB	Calf price divided by net initial for barley.
ACBOP	Off-board barley price distortion ($/tonne).
CBOP	Crow Offset Programs ($/tonne).
RNFL	Rainfall in mm. from April 1st to the first week in August.
NIB	Net initial for barley. Barley initial less the producer share of transport costs to Vancouver ($/tonne).
YR	Year.
LAC	One year lagged cultivated acreage.
CRNBAR	Ontario corn: Alberta feed cost ratio. Lagged one year fourth quarter prices. Feed cost = Lethbridge off-board barley price less the Crow Offset Programs.
PRCI	Provincial cow inventory for Alberta in '000 of head.
FDCOSTQ3	Current year third quarter feed cost. Lethbridge off-board barley price less the Crow Offset Programs.
RPSKSPR	Alberta - Saskatchewan calf price spread. Fourth quarter prices lagged one year.
SKFDSPR	Alberta feed cost - Saskatchewan barley price spread. Fourth quarter prices lagged one year ($/tonne).
STRSPR	Quarterly Alberta steer price ($CDN) -- Washington steer price ($US) spread. ($ per hundred pounds live weight).

Name	Description
L2FDCOST	Alberta feed cost (Lethbridge) lagged two quarters ($/tonne).
INTR	Bank of Canada interest rate (%).
SPAB	Alberta steer price ($ per hundred pounds live weight).
OBAR	Lethbridge off-board barley price.
HOGBAR	Hog - Barley ratio. Fourth quarter index 100 hog price lagged one year divided by feed cost for first quarter of current year.
D81	Dummy variable for 1981. 1981 = 1, 0 otherwise.
D83	Dummy variable for 1983. 1983 = 1, 0 otherwise.
DUM4	Fourth quarter dummy variable to correct for seasonality.
DUM87	Dummy variable for 1987. 1987 = 1, 0 otherwise.
D2	Second quarter dummy variable to correct for seasonality.
DUM84	Dummy variable for 1984. 1984 = 1, 0 otherwise.

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NOTE: FOR EQUATIONS WITH A LAGGED DEPENDENT VARIABLE,

THE REPORTED D.W. STATISTIC IS DURBIN'S h-STATISTIC.

1 . REGION 1 - BARLEY RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO 7 DF.	STAND. ERRORS	CONFIDENCE INTERVAL 95 PERCENT LEVEL LOWER	UPPER
FUTURE	-722.54	-4.16	173.50	- 1132.9	-312.21
GTRAN	428.34	3.66	117.11	151.37	705.30
YEAR	-483.25	-3.76	128.38	-786.87	-179.63
CONSTANT	959690	3.80	252710		

R^2 = (69.07) CORRECTED FOR AUTOCORRELATION)
R SQUARED ADJUSTED = (55.82)
D-W = 2.45
F STAT = CORRECTED FOR AUTOCORRELATION - F STAT ON ORIGINAL VARIABLES.
MEAN OF DEPENDENT VARIABLE = 4102.20
STANDARD ERROR OF THE ESTIMATE = 742.32
ESTIMATION PERIOD - 1978-1988

2 . REGION 1 - WHEAT RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO 6 DF.	STAND. ERRORS	CONFIDENCE INTERVAL 95 PERCENT LEVEL LOWER	UPPER
BAC	254.56	3.63	70.21	82.77	426.36
RNFALL	44.14	1.64	26.87	- 21.60	109.88
SUMF	41.07	1.83	22.44	-13.84	95.97
GTRAN	1479.50	4.39	337.04	654.75	2304.2
CONST.	- 80618	2.73	29514		

R^2 = 87.45
R SQUARED ADJUSTED = 79.08
D-W = 2.71
F STAT = 10.45
MEAN OF DEPENDENT VARIABLE = 27838
STANDARD ERROR OF THE ESTIMATE = 3336.40
ESTIMATION PERIOD - 1978-1988

3 . REGION 1 - CANOLA RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO 8 DF.	STAND. ERRORS	CONFIDENCE INTERVAL 95 PERCENT LEVEL LOWER	UPPER
NINTW	-244.97	-5.77	42.43	-342.83	-147.12
YEAR	92.13	9.70	9.50	70.22	114.04
CONSTANT	-181360.0	-9.64	18808		

R^2 = 93.0
R SQUARED ADJUSTED = 91.5
D-W = 2.29
F STAT = 54.88
MEAN OF DEPENDENT VARIABLE = 403.35
STANDARD ERROR OF THE ESTIMATE = 97.73
ESTIMATION PERIOD - 1978-1988

4 . REGION 2 - BARLEY RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO 5 DF.	STAND. ERRORS	CONFIDENCE INTERVAL 95 PERCENT LEVEL	
				LOWER	UPPER
FUT	-5073.3	-4.07	1246.2	- 8277	-1869.3
GTRAN	2042.4	3.03	672.97	312.16	3772.6
SUMF	105.5	5.00	21.07	51.34	159.66
NINTB	6502.6	2.01	3228.5	-1797.8	14803
YEAR	3037.6	2.36	1285.2	-266.71	6341.9
CONST.	- 6161200	-2.39	2568500		

R^2 = 92.30
R SQUARED ADJUSTED = 84.60
D-W = 2.97
F STAT = 11.98
MEAN OF DEPENDENT VARIABLE = 39347
STANDARD ERROR OF THE ESTIMATE = 4029.9
ESTIMATION PERIOD - 1978 - 1988

5 . REGION 2 - CANOLA RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO 8 DF.	STAND. ERRORS	CONFIDENCE INTERVAL 95 PERCENT LEVEL	
				LOWER	UPPER
NINTW	- 1801.2	4.55	395.58	- 2713	- 888.9
GTRAN	113.42	1.60	70.92	- 50.13	276.96
CONST.	10042	5.14	1955.50		

R^2 = (87.18) ON ORGIGINAL VARIABLES
R SQUARED ADJUSTED = 83.97
D-W = 2.09
F STAT =
MEAN OF DEPENDENT VARIABLE = 5370.6
STANDARD ERROR OF THE ESTIMATE = 622.32
ESTIMATION PERIOD - 1978 - 1988

6 . REGION 2 - WHEAT RESPONSE

	ESTIMATED COEFFICIENTS	T- RATIO 7 DF.	STAND. ERRORS	CONFIDENCE INTERVAL 95 PERCENT	
				LOWER	UPPER
FUT	- 4954.1	2.23	2225.3	-10217	308.65
GTRAN	5074.8	5.15	985.82	- 269.8	- 125.1
SUMF	49.74	2.24	22.24	1719.0	6846.2
CONST.	-80460	1.53	52756	- 15.48	105.19

R^2 = 92.69
R SQUARED ADJUSTED = 89.77
D-W = 1.40
F STAT = 31.71
MEAN OF DEPENDENT VARIABLE = 54246
STANDARD ERROR OF THE ESTIMATE = 5332.8

7 . REGION 3 - WHEAT RESPONSE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
GTRAN	2739.70	9.51	288.21	2058.1	3421.3
RNFALL	106.77	3.86	27.63	41.42	172.12
NINTB	-2894	-1.47	1970.0	-7553.1	1765.1
CONST.	-49496	-4.96	9974.7		

R^2 = 87.19
R SQUARED ADJUSTED = 81.70
D-W = 1.98
MEAN OF DEPENDENT VARIABLE = 15662
STANDARD ERROR OF THE ESTIMATE = 3353.4

8 . REGION 3 - BARLEY RESPONSE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
NINTB	10394	1.63	6389.8	-7344.3	28132
FUT	- 7621.7	-3.05	2498.8	-14558	-685.01
SUMF	204.50	3.67	55.75	49.74	359.26
GTRAN	3957.9	2.88	1374.3	142.89	7772.8
RNFALL	226.87	2.70	83.88	-5.99	459.73
WAC	102.46	3.07	33.37	9.84	195.09
CONST.	-159210.0	-3.19	49962.0		

R^2 = 91.42
R SQUARED ADJUSTED = 78.55
D-W = 3.13
F STAT = 7.10
MEAN OF DEPENDENT VARIABLE = 45854.0
STANDARD ERROR OF THE ESTIMATE = 7383.8

9 . REGION 3 - CANOLA RESPONSE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	CONFIDENCE INTERVAL UPPER
GTRAN	85.32	2.35	36.33	-3.58	174.23
RNFALL	15.44	3.91	3.95	5.77.	25.11
NINTW	-1671	-12.23	12.23	-2000.4	-1336.6
CANST	-0.012	-4.96	0.0024	-0.018	-0.0061
CONST.	6219.5	4.62	1347.0		

R^2 = 92.58
R SQUARED ADJUSTED = 87.64
D-W = 1.86
MEAN OF DEPENDENT VARIABLE = 3878.9
STANDARD ERROR OF THE ESTIMATE = 445.19

10 . REGION 4 - BARLEY RESPONSE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	CONFIDENCE INTERVAL UPPER
NINTB	4963.6	3.73	1332.2	1538.6	8388.6
FUT	-3488.5	-6.75	517.12	-4818.0	-2159.0
BARST	-0.01005	-7.53	0.0013	-0.013	-0.0066
GTRAN	3096.0	15.55	199.06	2584.2	3607.8
SUMF	29.314	9.75	3.007	21.58	37.05
CONST.	-17525.0	2.05	8531.2		

R^2 = 98.62 R SQUARED DONE ON ORIGINAL VARIABLES
R SQUARED ADJUSTED = 97.24
D-W = 2.30
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 48536
STANDARD ERROR OF THE ESTIMATE = 1925.0

11 . REGION 4 - CANOLA RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
SUMF	-12.75	-2.69	4.74	-23.98	-1.53
GTRAN	473.24	1.64	288.35	-208.71	1155.2
NINTB	-10452	-5.39	1940.1	-15040	-5863.3
CONST.	45261	3.70	12243		

R^2 = 89.82 CALCULATED ON ORGININAL VARIABLES
R SQUARED ADJUSTED = 85.45
D-W = 1.91
MEAN OF THE DEPENDENT VARIABLE = 18516
STANDARD ERROR OF THE ESTIMATE = 2226.3

12 . REGION 4 - WHEAT RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
NINTW	13804	7.75	1781.3	9224.4	18384
FUT	-4121.0	-3.60	1144.8	-7064.2	-1177.9
GTRAN	884.83	2.85	310.63	86.20	1683.5
BAC	-47.41	-4.47	10.61	-74.68	-20.14
RNFALL	190.40	3.40	56.08	46.22	334.57
CONST.	22432	1.40	16014		

R^2 = 95.67
R SQUARED ADJUSTED = 91.34
D-W = 3.19
F STAT = 22.10
MEAN OF DEPENDENT VARIABLE = 53460
STANDARD ERROR OF THE ESTIMATE = 3210.3

13 . REGION 5 - WHEAT RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
NINTW	2514.2	7.08	354.89	1645.8	3382.6
FUT	-421.27	-1.90	221.22	-962.6	120.05
GTRAN	258.47	4.26	60.64	110.08	406.86
BAC	-9.03	-3.06	2.95	-16.25	-1.81
CONST.	7190.9	2.36	3047.6		

R^2 = 90.58
R SQUARED ADJUSTED = 84.29
D-W = 2.83
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 7962.3
STANDARD ERROR OF THE ESTIMATE = 787.21

14 . REGION 5 - BARLEY RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
NINTB	17731	6.33	2800.9	10877	24585
NINTW	-10672	-7.10	1503.8	-14352	-6992.6
GTRAN	1665.8	10.60	157.11	1281.4	2050.2
BARST	-0.0097	-6.68	0.0015	-0.013	-0.0062
CONST.	46958	10.42	4505.4		

R^2 = 95.82 CALCULATED ON ORIGINAL VARIABLES
R SQUARED ADJUSTED = 93.03
D-W = 2.59
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 64898
STANDARD ERROR OF THE ESTIMATE = 2251.5

15 . REGION 5 - CANOLA RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
CANST	-0.043	-2.86	0.015	-0.079	-0.0075
BARST	-0.0032	-1.91	0.0017	-0.0073	-0.0008
RNFALL	23.015	2.62	2.62	2.25	43.77
CONST.	11486	4.05	2834.9		

R^2 = 64.20
R SQUARED ADJUSTED = 48.85
D-W = 1.22
MEAN OF DEPENDENT VARIABLE = 11208
STANDARD ERROR OF THE ESTIMATE = 2064.8

16 . REGION 5 - OATS RESPONSE

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
OAC	22.36	3.84	5.82	8.11	36.60
FUT	-884.11	-2.00	442.98	-1968.1	199.86
RNFALL	13.42	1.82	7.39	-4.66	31.50
GTRAN	176.08	1.26	139.2	-164.54	516.69
CONST.	11406	2.30	4966.2		

R^2 = 85.36
R SQUARED ADJUSTED = 75.61
D-W = 1.70
MEAN OF DEPENDENT VARIABLE = 17475
STANDARD ERROR OF THE ESTIMATE = 1411.1

17 . REGION 6 - BARLEY RESPONSE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
NINTB	6948.4	3.08	2253.4	1434.3	12462
FUT	-2586.4	-2.54	1017.1	-115.12	-2.22
GOVTRA	1647.4	6.86	240.22	1059.6	2235.2
RNFALL	-78.77	-2.59	30.42	-153.21	-78.77
CONST.	25824	1.93	13410		

R^2 = 88.67
R SQUARED ADJUSTED = 81.11
D-W = 2.16
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 33695
STANDARD ERROR OF THE ESTIMATE = 3434.0

18 . REGION 6 - WHEAT RESPONSE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
NINTW	1361.6	3.50	389.09	409.51	2313.7
FUT	734.76	2.88	255.14	110.44	1359.1
RNFALL	20.606	2.37	8.68	-0.64	41.85
CONST.	-8724.4	2.10	4151.8		

R^2 =(72.75)
R SQUARED ADJUSTED = (59.13)
D-W = 1.85
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 6808.1
STANDARD ERROR OF THE ESTIMATE = 927.51

19 . REGION 6 - CANOLA RESPONSE

ESTIMATED	COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	UPPER
YEAR	399.09	2.44	163.73	11.874	786.31
LPROC	0.54746	2.10	0.26	-680760	1.16
CONST.	-789220	2.43	324240		

R^2 = 83.89
R SQUARED ADJUSTED = 71.00
D-W = 2.41
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 4936.1
STANDARD ERROR OF ESTIMATE = 1207.9

20 . REGION 7 - WHEAT RESPONSE

ESTIMATED	COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	UPPER
FUT	3014.7	4.31	699.91	1359.4	4670
GTRA	695.09	2.25	309.15	-36.06	1426.2
SUMF	-19.74	-4.69	4.21	-29.70	-9.78
CONST.	-823.23	-0.086	9578.2		

R^2 = 84.53 CALCULATED ON ORGINAL VARIABLES
R SQUARED ADJUSTED = 77.90
D-W = 2.09
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 20328
STANDARD ERROR OF THE ESTIMATE = 3095.5

21 . REGION 7 - BARLEY RESPONSE

ESTIMATED	COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	UPPER
NINTB	4250.5	1.80	2358.1	-33.08	218.13
FUT	-2356.9	-2.69	875.30	-102.04	-4.88
GTRA	779.44	2.41	323.95	-13.27	1572.2
RNFALL	51.51	2.11	24.46	-8.35	111.37
CONST.	19846	2.42	8193.0		

R^2 = 83.0 CALCULATED ON ORGINAL VARIABLES
R SQUARED ADJUSTED = 71.67
D-W = 2.14
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 35749
STANDARD ERROR OF THE ESTIMATE = 2782.7

22 . REGION 7 - CANOLA SUPPLY

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
NINTB	-8395.3	-15.72	1565.7	-12229	-4823.7
GTRA	338.84	1.31	258.55	-272.64	950.31
CONST.	24505	4.23	5795.0		

R^2 = 81.31
R SQUARED ADJUSTED = 75.96
D-W = 2.19
F STAT = 15.22
MEAN OF DEPENDENT VARIABLE = 13697
STANDARD ERROR OF THE ESTIMATE = 1935.2

23 . BARLEY PRICE EQUATION - RED DEER REGION - AGC PRICES

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	ELASTICITY AT THE MEANS
INTBRD	0.13	4.06	0.03	0.11
LSU	-4.44	2.84	1.56	0.06
ADJ	0.57	5.26	0.11	0.02
LAGRD1	0.83	24.55	0.04	0.82
CONST.	-1.21	0.58	2.08	0.012

R^2 = 96.74
R SQUARED ADJUSTED = 96.62
D-W = 1.22
F STAT = 845.03
MEAN OF DEPENDENT VARIABLE = 100.81
STANDARD ERROR OF THE ESTIMATE = 4.66
MIN. PERCENT ERROR = 0.00
MAX PERCENT ERROR = 24.81
MEAN PERCENT ERROR = 3.63

24 . BARLEY PRICE EQUATION - GRAND PRAIRIE REGION - AGC PRICES

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	ELASTICITY AT THE MEANS
INTBGP	0.14	4.12	0.04	0.12
LSU	-4.94	3.11	1.58	0.06
ADJ	0.47	4.29	0.11	0.02
LAGGRP	0.81	21.67	0.04	0.81
CONST.	-0.12	0.05	2.32	0.02

R^2 = 95.09
R SQUARED ADJUSTED = 94.92
D-W = 1.57
F STAT = 552.12
MEAN OF DEPENDENT VARIABLE = 101.00
STANDARD ERROR OF THE ESTIMATE = 5.09
MIN PERCENT ERROR = 0.02
MAX PERCENT ERROR = 19.76
MEAN PERCENT ERROR = 3.07

25 . BARLEY PRICE EQUATION - MEDICINE HAT REGION - AGC PRICES

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	ELASTICITY AT THE MEANS
INTMED	0.11	2.97	0.04	0.09
LSU	-4.06	2.16	1.87	0.05
ADJ	0.54	4.22	0.13	0.02
LAGMH	0.84	21.77	0.04	0.84
CONST.	0.75	0.31	2.40	0.07

R^2 = 95.70
R SQUARED ADJUSTED = 95.55
D-W = 1.13
F STAT = 633.76
MEAN OF DEPENDENT VARIABLE = 104.73
STANDARD ERROR OF THE ESTIMATE = 5.39
MIN PERCENT ERROR = 0.03
MAX PERCENT ERROR = 22.17
MEAN PERCENT ERROR = 4.06

26 . BARLEY PRICE EQUATION - LETHBRIDGE REGION - AGC PRICES

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	ELASTICITY AT THE MEANS
INTBLE	0.099	2.68	0.04	0.08
LSU	-4.19	2.06	2.03	0.05
ADJ	0.56	4.12	0.13	0.02
LAGLE	0.85	21.97	0.04	0.85
CONST.	0.32	0.12	2.57	0.003

R^2 = 95.47
R SQUARED ADJUSTED = 95.31
D-W = 1.16
F STAT = 600.86
MEAN OF DEPENDENT VARIABLE = 106.14
STANDARD ERROR OF THE ESTIMATE = 5.76
MIN PERCENT ERROR = 0.06
MAX PERCENT ERROR = 36.47
MEAN PERCENT ERROR = 4.07

27 . BARLEY PRICE EQUATION - CALGARY REGION - AGC PRICES

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	ELASTICITY AT THE MEANS
INTBCA	0.10	3.24	0.03	0.09
LSU	-4.97	2.84	1.74	0.06
ADJ	0.60	5.06	0.12	0.02
LAGCAL	0.84	23.62	0.04	0.84
CONST.	-0.17	0.08	2.23	0.017

R^2 = 96.19
R SQUARED ADJUSTED = 96.06
D-W = 1.17
F STAT = 720.28
MEAN OF DEPENDENT VARIABLE = 103.39
STANDARD ERROR OF THE ESTIMATE = 4.99
MIN PERCENT ERROR = 0.01
MAX PERCENT ERROR = 22.33
MEAN PERCENT ERROR = 3.79

28 . BARLEY PRICE EQUATION - VERMILION REGION - AGC PRICES

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	ELASTICITY AT THE MEANS
INTBVER	0.16	5.01	0.03	0.14
LSU	-3.63	2.65	1.37	0.05
ADJ	0.51	5.02	0.10	0.02
LAGVER	0.81	24.07	0.04	0.81
CONST.	-1.09	0.55	1.99	0.011

R^2 = 96.62
R SQUARED ADJUSTED = 96.50
D-W = 1.22
F STAT = 814.73
MEAN OF DEPENDENT VARIABLE = 96.34
STANDARD ERROR OF THE ESTIMATE = 4.56
MIN PERCENT ERROR = 0.04
MAX PERCENT ERROR = 13.64
MEAN PERCENT ERROR = 3.66

29 . BARLEY PRICE EQUATION - EDMONTON REGION - AGC PRICES

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	ELASTICITY AT THE MEANS
INTED	0.14	4.71	0.03	0.12
LSU	-4.22	3.00	1.41	0.05
ADJ	0.57	5.64	0.10	0.02
LAGEDM	0.82	25.07	0.03	0.81
CONST.	-0.81	0.43	1.91	0.008

R^2 = 97.11
R SQUARED ADJUSTED = 97.00
D-W = 1.21
F STAT = 936.43
MEAN OF DEPENDENT VARIABLE = 101.01
STANDARD ERROR OF THE ESTIMATE = 4.27
MIN PERCENT ERROR = 0.11
MAX PERCENT ERROR = 13.01
MEAN PERCENT ERROR = 3.32

30 . REGION 1 BEEF COW INVENTORY (MEDICINE HAT)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LCIHI1	0.704	6.21	0.11	0.43	0.98
D81	-18.994	-5.42	3.51	-27.58	-10.41
CONST.	29.678	1.28	23.24		

R^2 = 89.71
R SQUARED ADJUSTED = 86.28
D-W = 1.94
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 172.11
STANDARD ERROR OF THE ESTIMATE = 3.06
ESTIMATION PERIOD FOR ALL LIVESTOCK INVENTORY EQUATIONS = 1979 TO 1988

31 . REGION 2 BEEF COW INVENTORY (LETHBRIDGE)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LHI2	2.42	4.75	0.51	1.17	3.67
LRNFL2	0.11	2.30	0.050	-0.0073	0.24
CONST.	88.80	7.81	11.36		

R^2 = 91.25
R SQUARED ADJUSTED = 88.33
D-W = 1.81
F STAT = 31.28
MEAN OF DEPENDENT VARIABLE = 175.44
STANDARD ERROR OF THE ESTIMATE = 6.32

32 . REGION 3 BEEF COW INVENTORY (CALGARY)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LCI3	1.037	10.46	0.0991	0.72	1.35
L3RPSL	0.339	3.57	0.0948	0.037	0.64
LCALPRI	-0.185	-3.67	0.0503	-0.34	-0.025
CONST.	-21.174		21.064		

R^2 = 97.81
R SQUARED ADJUSTED = 95.62
D-W = 3.12
F-STAT = 44.71
MEAN OF DEPENDENT VARIABLE = 221.71
STANDARD ERROR OF THE ESTIMATE = 2.23

33 . REGION 4 BEEF COW INVENTORY (VERMILION)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LCI4	0.779	5.14	0.152	0.42	1.14
L3RPNL	0.339	4.39	0.0772	0.16	0.52
LVERPRI	-0.214	-5.27	0.04067	-0.31	-0.12
CONST.	49.828	1.37	36.49		

R^2 = 83.66
R SQUARED ADJUSTED = 67.33
D-W = 2.35
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 254.57
STANDARD ERROR OF THE ESTIMATE = 2.08

34 . REGION 5 BEEF COW INVENTORY (RED DEER)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LCI5	0.38	2.04	0.19	-0.041	0.80
RPW5	12.55	3.38	3.71	4.15	20.95
LRNFL5	0.014	2.04	0.0068	-0.0015	0.029
D81	-9.85	-4.13	2.39	-15.26	-4.45
CONST.	146.20	3.14	46.61		

R^2 = 72.82
R SQUARED ADJUSTED = 45.64
D-W = 0.94
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 249.89
STANDARD ERROR OF THE ESTIMATE = 1.83

35 . REGION 6 BEEF COW INVENTORY (WESTLOCK)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER.
LHI6	0.554	1.65	0.34	-0.31	1.42
RPW6	9.962	2.99	3.33	1.40	18.52
D81	-7.831	-2.72	2.88	-15.25	-0.42
CONST.	192.860	16.05	12.01		

R^2 = 89.32
R SQUARED ADJUSTED = 82.92
F - STAT = 13.95
D-W = 1.69
MEAN OF DEPENDENT VARIABLE = 218.33
STANDARD ERROR OF THE ESTIMATE = 2.11

36 . REGION 7 BEEF COW INVENTORY (PEACE RIVER)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
NIB7	-0.097	-1.28	0.076	-0.28	0.088
LHI7	1.34	1.22	1.10	-1.34	4.02
CONST.	63.66	3.15	20.19		

R^2 = 58.06
R SQUARED ADJUSTED = 44.08
D-W = 1.60
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 73.33
STANDARD ERROR OF THE ESTIMATE = 3.64

37 . REGION 1 HEIFER REPLACEMENT INVENTORY (MEDICINE HAT)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
RPW1	15.08	9.98	1.51	11.38	18.78
LCIHI1	0.040	1.56	0.026	-0.023	0.10
CONST.	12.31	2.31	5.33		

R^2 = 92.88
R SQUARED ADJUSTED = 90.51
D-W = 1.67
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 30.61
STANDARD ERROR OF THE ESTIMATE = 1.18

38 . REGION 2 HEIFER REPLACEMENT INVENTORY (LETHBRIDGE)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
RPW2	8.60	6.97	1.24	5.58	11.63
LCI2	0.14	11.43	0.013	0.11	0.17
CONST.	-6.06	-2.26	2.67		

R^2 = 92.49
R SQUARED ADJUSTED = 89.99
D-W = 2.08
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 25.52
STANDARD ERROR OF THE ESTIMATE = 0.97

39 . REGION 3 HEIFER REPLACEMENT INVENTORY (CALGARY)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
RPB3	10.496	7.23	1.452	6.76	14.23
YR	-1.357	-6.96	0.195	-1.86	-0.86
CONST.	2725.1	7.06	386.04		

R^2 = 91.22
R SQUARED ADJUSTED = 87.71
D-W = 1.86
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 42.0
STANDARD ERROR OF THE ESTIMATE = 1.07

40 . REGION 4 HEIFER REPLACEMENT INVENTORY (VERMILION)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	CONFIDENCE INTERVAL UPPER
LHI4	0.75	4.23	0.18	0.35	1.15
RPW4	7.70	2.48	3.10	0.67	14.72
CONST.	6.52	1.01	6.47		

R^2 = 74.32
R SQUARED ADJUSTED = 65.76
D-W = 1.74
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 39.82
STANDARD ERROR OF THE ESTIMATE = 2.43

41 . REGION 5 HEIFER REPLACEMENT INVENTORY (RED DEER)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	CONFIDENCE INTERVAL UPPER
LHI5	0.15	4.15	0.037	0.070	0.24
RPW5	21.22	21.26	1.00	18.96	23.48
CONST.	26.99	16.77	1.61		

R^2 = 97.71
R SQUARED ADJUSTED = 96.94
D-W = 2.28
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 47.99
STANDARD ERROR OF THE ESTIMATE = 0.80

42 . REGION 6 HEIFER REPLACEMENT INVENTORY (WESTLOCK)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	CONFIDENCE INTERVAL UPPER
LHI6	0.53	2.66	0.20	0.080	0.98
LCI6	0.27	1.80	0.15	-0.070	0.62
RPW6	4.38	1.75	2.51	-1.30	10.07
CONST.	-43.83	-1.53	28.61		

R^2 = 81.90
R SQUARED ADJUSTED = 71.05
D-W = 1.81
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 37.46
STANDARD ERROR OF THE ESTIMATE = 1.50

43 . REGION 7 HEIFER REPLACEMENT INVENTORY (PEACE RIVER)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
RPB7	3.23	1.97	1.64	-0.78	7.24
LAC7	0.0072	1.33	0.0054	-0.0061	0.021
CONST.	-11.61	-0.72	16.24		

R^2 = 73.98
R SQUARED ADJUSTED = 65.30
D-W = 1.82
F - STAT = 8.529
MEAN OF DEPENDENT VARIABLE = 14.49
STANDARD ERROR OF THE ESTIMATE = 1.18

44 . REGION 1 FEEDER STEER AND HEIFER INVENTORY (MEDICINE HAT)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LCI1	0.27	8.08	0.033	0.18	0.35
LRNFL1	0.038	5.24	0.0072	0.019	0.056
RPS4	-0.11	-5.44	0.020	-0.16	-0.058
CONST.	14.70	2.39	6.16		

R^2 = 97.11
R SQUARED ADJUSTED = 95.37
D-W = 1.92
F STAT = 55.93
MEAN OF DEPENDENT VARIABLE = 56.60
STANDARD ERROR OF THE ESTIMATE = 0.82

45 . REGION 2 FEEDER STEER AND HEIFER INVENTORY (LETHBRIDGE)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
RPS4	-3.0086	-5.90	0.51	-4.42	-1.59
CRNBAR	140.16	5.42	25.84	68.42	211.9
LSKEXP	0.00104	4.03	0.00026	0.00032	0.0018
LPRCI	0.357	3.67	0.097	0.087	0.63
CONST.	-337.58	-2.80	120.76		

R^2 = 95.27
R SQUARED ADJUSTED = 90.54
D-W = 2.58
F - STAT = 20.15
MEAN OF DEPENDENT VARIABLE = 235.52
STANDARD ERROR OF THE ESTIMATE = 11.20

46 . REGION 3 FEEDER STEER AND HEIFER INVENTORY (CALGARY)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	UPPER
CI3	1.118	2.34	0.48	-0.11	2.35
LRNFL3	0.238	1.92	0.12	-0.081	0.56
LSKEXP	0.000282	1.29	0.00022	-0.00028	0.00084
CONST.	-209.27	-2.76	75.93		

R^2 = 89.39
R SQUARED ADJUSTED = 83.02
D-W = 2.27
F - STAT = 14.04
MEAN OF DEPENDENT VARIABLE = 143.71
STANDARD ERROR OF THE ESTIMATE = 11.23

47 . REGION 4 FEEDER STEER AND HEIFER INVENTORY (VERMILION)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	UPPER
CI4	0.63	4.62	0.14	0.30	0.97
LSKEXP	0.00011	1.03	0.00011	-0.0002	0.00038
CONST.	-60.57	-1.82	33.35		

R^2 = 83.66
R SQUARED ADJUSTED = 78.21
D-W = 2.24
F-STAT = 15.36
MEAN OF DEPENDENT VARIABLE = 123.67
STANDARD ERROR OF THE ESTIMATE = 6.67

48 . REGION 5 FEEDER STEER AND HEIFER INVENTORY (RED DEER)

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL LOWER	UPPER
RPN4	-1.17	-2.84	0.41	-2.32	-0.028
CRNBAR	50.74	2.48	20.49	-6.15	107.62
LSKEXP	0.00042	2.01	0.00021	-0.00016	0.00099
LPRCI	0.18	2.35	0.078	-0.033	0.40
CONST.	-123.86	-1.28	96.54		

R^2 = 87.89
R SQUARED ADJUSTED = 75.78
D-W = 1.73
F STAT = 7.26
MEAN OF DEPENDENT VARIABLE = 159.72
STANDARD ERROR OF THE ESTIMATE = 8.97

49 . REGION 6 FEEDER STEER AND HEIFER INVENTORY (WESTLOCK)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LCI6	0.13	1.22	0.10	-0.14	0.40
FDCOSTQ3	-0.041	-2.56	0.016	-0.081	0.00019
D83	-7.76	-6.06	1.28	-11.05	-4.47
CONST.	55.26	2.41	22.94		

R^2 = 89.97
R SQUARED ADJUSTED = 83.95
D-W = 1.36
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 77.84
STANDARD ERROR OF THE ESTIMATE = 1.33

50 . REGION 7 FEEDER STEER AND HEIFER INVENTORY (PEACE RIVER)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LCI7	0.17	2.25	0.075	-0.024	0.36
RPN4	-0.037	-2.04	0.018	-0.083	0.0095
LSKEXP	0.000029	2.47	0.000012	-0.1-05	0.59-04
CONST.	5.52	1.27	4.34		

R^2 = 76.62
R SQUARED ADJUSTED = 62.59
D-W = 2.31
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 19.48
STANDARD ERROR OF THE ESTIMATE = 0.79

51 . PROVINCIAL EXPORTS OF FEEDER CATTLE TO ONTARIO

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
CRNBAR	-97726.0	-3.61	27076.0	-161760	-33691
RPSKSPR	12085.0	2.64	4583.4	1245.2	22925
CONST.	248060.0	6.72	36173.0		

R^2 = 70.88
R SQUARED ADJUSTED = 62.57
D-W = 1.61
F STAT = 8.52
MEAN OF DEPENDENT VARIABLE = 135540.0
STANDARD ERROR OF THE ESTIMATE = 25383.0

52 . PROVINCIAL IMPORTS OF FEEDER CATTLE FROM SASKATCHEWAN

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
RPSKSPR	9398.4	3.66	2570.4	3319.5	15477
SKFDSPR	-568.73	-1.42	401.38	-1518.0	380.54
CONST.	161360.0	20.97	7694.9		

R^2 = 73.72
R SQUARED ADJUSTED = 66.22
D-W = 1.74
F STAT = 9.82
MEAN OF DEPENDENT VARIABLE = 173860.0
STANDARD ERROR OF THE ESTIMATE = 13940.0

53 . PROVINCIAL EXPORTS OF LIVE SLAUGHTER STEERS AND HEIFERS TO THE U.S.A.

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
STRSPR	-4147.80	-4.46	929.94	-6174.1	-2121.5
L2FDCOST	-221.90	-2.73	81.15	-398.73	-45.07
DUM4	-9416.80	-2.35	4007.20	-18149	-685.04
DUM87	29747.00	4.11	7229.80	13993	45501
CONST.	112680.00	7.33	15367.00		

R^2 = 88.28
R SQUARED ADJUSTED = 84.37
D-W = 1.93
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 27331.00
STANDARD ERROR OF THE ESTIMATE = 7725.00

54 . AVERAGE CARCASS WEIGHT OF CATTLE SLAUGHTERED IN ALBERTA

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
L2FDCOST	-0.31	-1.31	0.23	-0.78	0.17
INTR	-3.08	-1.49	2.07	-7.26	1.10
D2	-17.01	-3.34	5.10	-27.31	-6.71
CONST.	698.46	21.41	32.62		

R^2 = 66.08
R SQUARED ADJUSTED = 63.00
D-W = 1.86
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 620.43
STANDARD ERROR OF THE ESTIMATE = 18.68

55 . SOUTHERN ALBERTA CALF PRICE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LRPSL	0.44	4.82	0.091	0.26	0.62
SPAB	0.72	4.01	0.18	0.36	1.10
LOBAR	-0.21	-5.24	0.040	-0.29	-0.13
CBOP	0.17	1.47	0.11	-0.060	0.39
CONST.	17.97	1.55	11.61		

R^2 = 90.07
R SQUARED ADJUSTED = 89.00
D-W = 1.97
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 92.08
STANDARD ERROR OF THE ESTIMATE = 4.50

56 . CENTRAL AND NORTHERN ALBERTA CALF PRICE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LRPNL	0.46	6.04	0.076	0.31	0.61
SPAB	0.73	4.43	0.16	0.40	1.05
LOBAR	-0.19	-6.17	0.031	-0.26	-0.13
CBOP	0.21	2.31	0.90	0.028	0.39
CONST.	13.48	1.37	9.87		

R^2 = 91.33
R SQUARED ADJUSTED = 90.39
D-W = 2.03
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 90.53
STANDARD ERROR OF THE ESTIMATE = 4.13

57 . SOUTHERN ALBERTA HEAVY FEEDER PRICE

	ESTIMATED COEFFICIENTS	T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LRPSH	0.34	5.88	0.058	0.22	0.46
SPAB	0.67	7.34	0.092	0.49	0.86
LOBAR	-0.10	-8.37	0.012	-0.13	-0.079
CBOP	0.16	4.14	0.039	0.083	0.24
CONST.	11.98	2.50	4.79		

R^2 = 91.87
R SQUARED ADJUSTED = 91.00
D-W = 1.82
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 80.23
STANDARD ERROR OF THE ESTIMATE = 2.33

58 . CENTRAL AND NORTHERN ALBERTA HEAVY FEEDER PRICE

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LRPNH	0.34	5.01	0.067	0.20	0.47
SPAB	0.66	6.41	0.10	0.45	0.86
LOBAR	-0.11	-7.12	0.015	-0.14	-0.077
CBOP	0.14	3.07	0.046	0.049	0.23
CONST.	12.98	2.30	5.64		

R^2 = 89.32
R SQUARED ADJUSTED = 88.16
D-W = 1.88
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 78.76
STANDARD ERROR OF THE ESTIMATE = 2.64

59 . REGION 1 HOG BREEDING STOCK INVENTORY (MEDICINE HAT)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LHOG1	0.89	16.58	0.054	0.78	1.01
HOGBAR	0.48	3.37	0.14	0.17	0.80
DUM84	0.70	2.93	0.24	0.18	1.22
CONST.	0.75	2.73	0.27		

R^2 = 98.38
R SQUARED ADJUSTED = 97.77
D-W = 1.95
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 5.93
STANDARD ERROR OF THE ESTIMATE = 0.24

60 . REGION 2 HOG BREEDING STOCK INVENTORY (LETHBRIDGE)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LHOG2	0.79	8.57	0.092	0.59	1.00
HOGBAR	2.45	3.88	0.63	1.08	3.83
DUM84	4.57	4.41	1.04	2.31	6.82
CONST.	6.57	2.44	2.69		

R^2 = 96.63
R SQUARED ADJUSTED = 95.37
D-W = 1.34
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 31.01
STANDARD ERROR OF THE ESTIMATE = 1.16

61 . REGION 3 HOG BREEDING STOCK INVENTORY (CALGARY)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LHOG3	0.52	5.56	0.094	0.32	0.73
HOGBAR	2.43	6.90	0.35	1.66	3.20
DUM84	3.10	4.98	0.62	1.74	4.45
CONST.	5.99	4.33	1.38		

R^2 = 94.61
R SQUARED ADJUSTED = 92.59
D-W = 1.95
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 15.08
STANDARD ERROR OF THE ESTIMATE = 0.66

62 . REGION 4 HOG BREEDING STOCK INVENTORY (VERMILION)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LHOG4	0.50	5.18	0.096	0.29	0.71
HOGBAR	2.82	6.89	0.41	1.93	3.71
DUM84	3.88	5.45	0.71	2.33	5.43
CONST.	10.84	4.70	2.31		

R^2 = 93.87
R SQUARED ADJUSTED = 91.58
D-W = 1.54
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 24.42
STANDARD ERROR OF THE ESTIMATE = 0.77

63 . REGION 5 HOG BREEDING STOCK INVENTORY (RED DEER)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LHOG5	0.77	7.89	0.097	0.56	0.98
HOGBAR	4.70	5.88	0.80	2.96	6.44
DUM84	6.13	4.64	1.32	3.25	9.01
CONST.	8.44	2.21	3.83		

R^2 = 96.86
R SQUARED ADJUSTED = 95.68
D-W = 1.60
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 39.68
STANDARD ERROR OF THE ESTIMATE = 1.53

64 . REGION 6 HOG BREEDING STOCK INVENTORY (WESTLOCK)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LHOG6	0.61	8.92	0.069	0.46	0.76
HOGBAR	2.11	4.88	0.43	1.17	3.05
DUM84	2.38	3.35	0.71	0.83	3.92
CONST.	8.27	5.94	1.39		

R^2 = 96.45
R SQUARED ADJUSTED = 95.12
D-W = 1.80
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 23.21
STANDARD ERROR OF THE ESTIMATE = 0.68

65 . REGION 7 HOG BREEDING STOCK INVENTORY (PEACE RIVER)

ESTIMATED COEFFICIENTS		T- RATIO	STAND. ERRORS	CONFIDENCE INTERVAL	
				LOWER	UPPER
LHOG7	0.59	6.84	0.086	0.40	0.77
HOGBAR	0.70	6.43	0.11	0.46	0.94
DUM84	0.89	4.80	0.19	0.49	1.30
CONST.	2.37	4.45	0.53		

R^2 = 95.81
R SQUARED ADJUSTED = 94.24
D-W = 1.62
CORRECTED FOR AUTOCORRELATION
MEAN OF DEPENDENT VARIABLE = 6.51
STANDARD ERROR OF THE ESTIMATE = 0.20

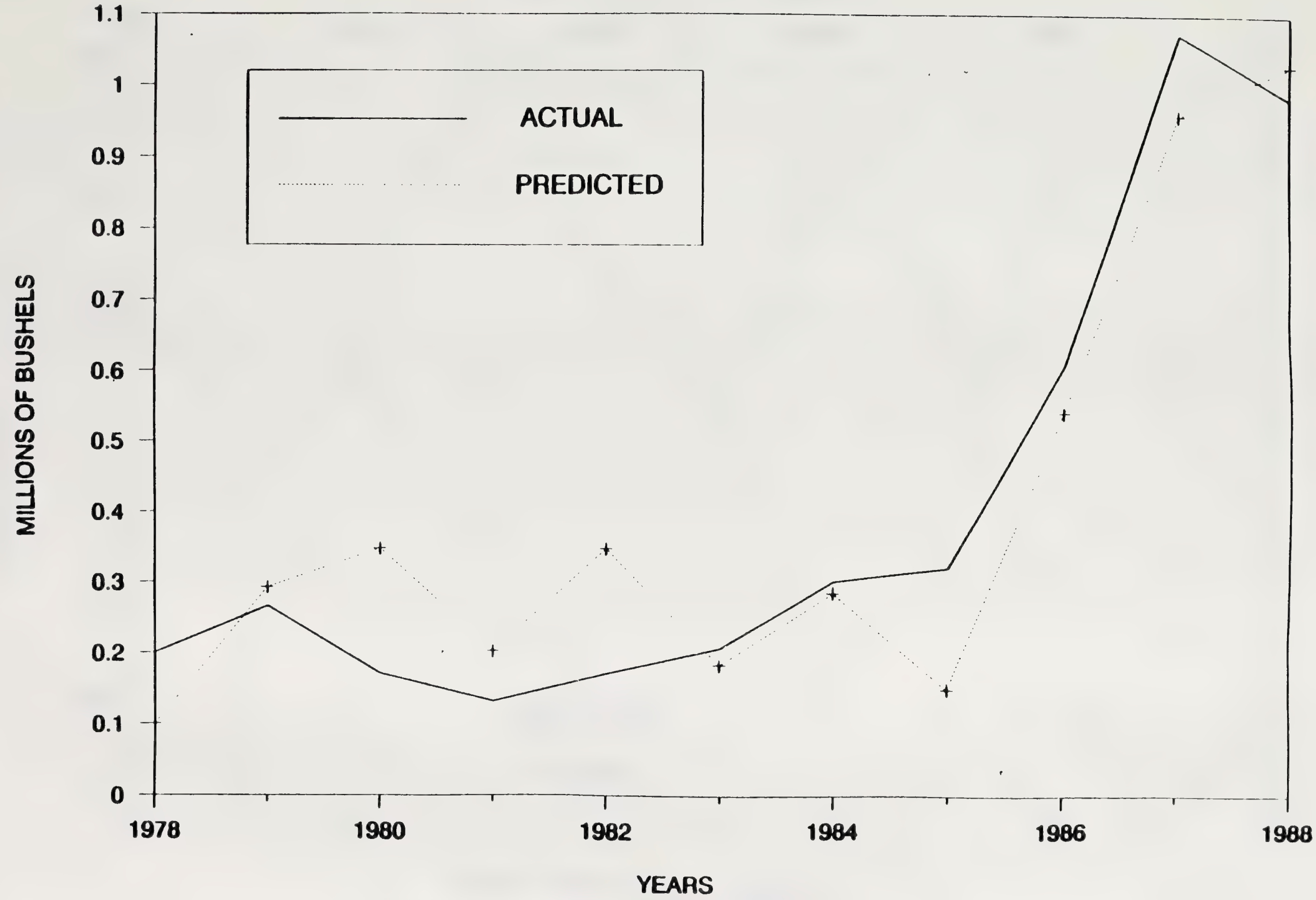
APPENDIX C

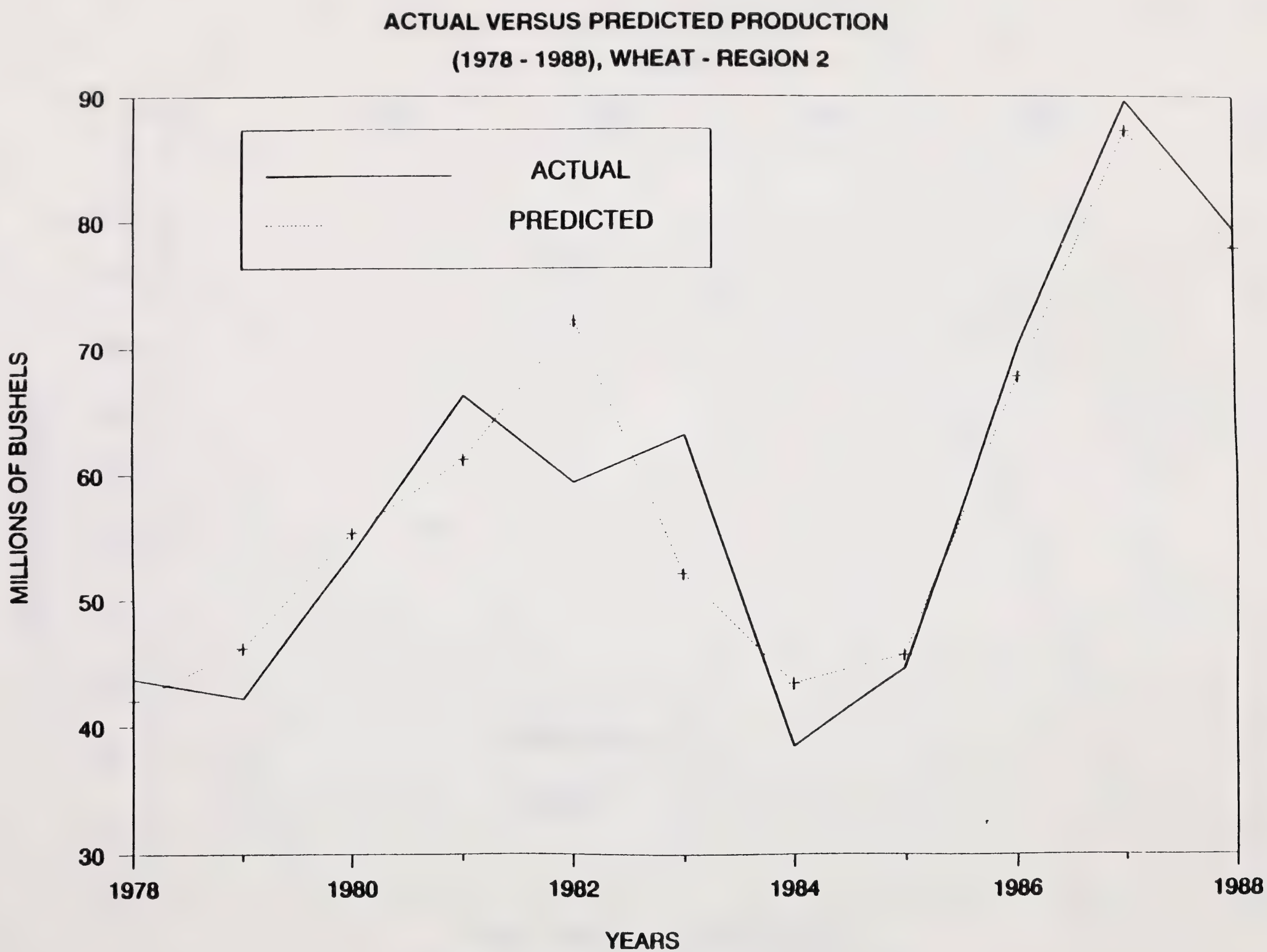
REGIONAL CROP AND LIVESTOCK GRAPHS

DEPICTING ACTUAL VERSUS PREDICTED LEVELS.

ACTUAL VERSUS PREDICTED PRODUCTION

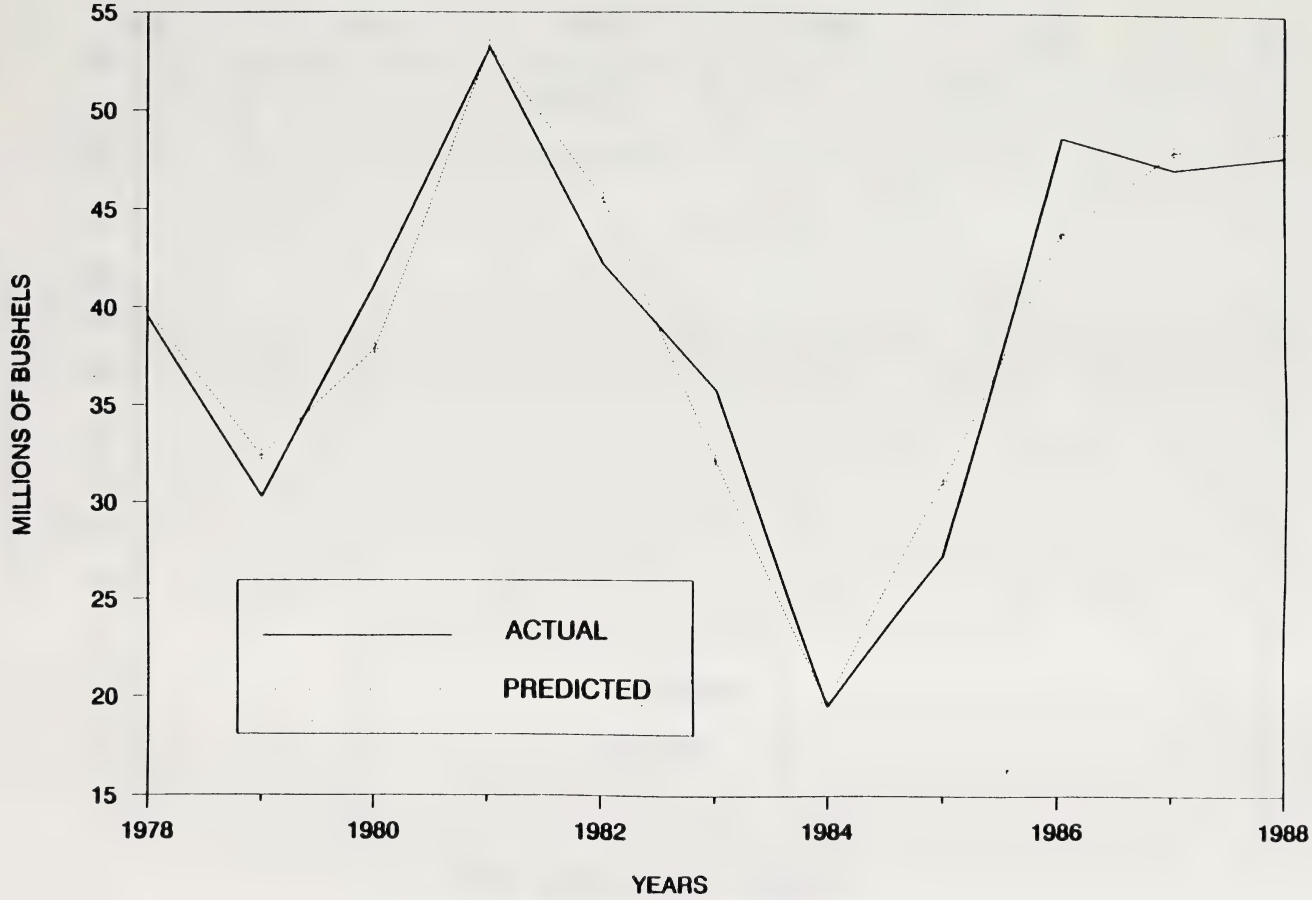
(1978 - 1988), CANOLA - REGION 1




ACTUAL VERSUS PREDICTED PRODUCTION
(1978 - 1988), WHEAT - REGION 2
ACTUAL
PREDICTED
MILLIONS OF BUSHELS
90
80
70
60
50
40
30
1978
1980
1982
1984
1986
1988
YEARS

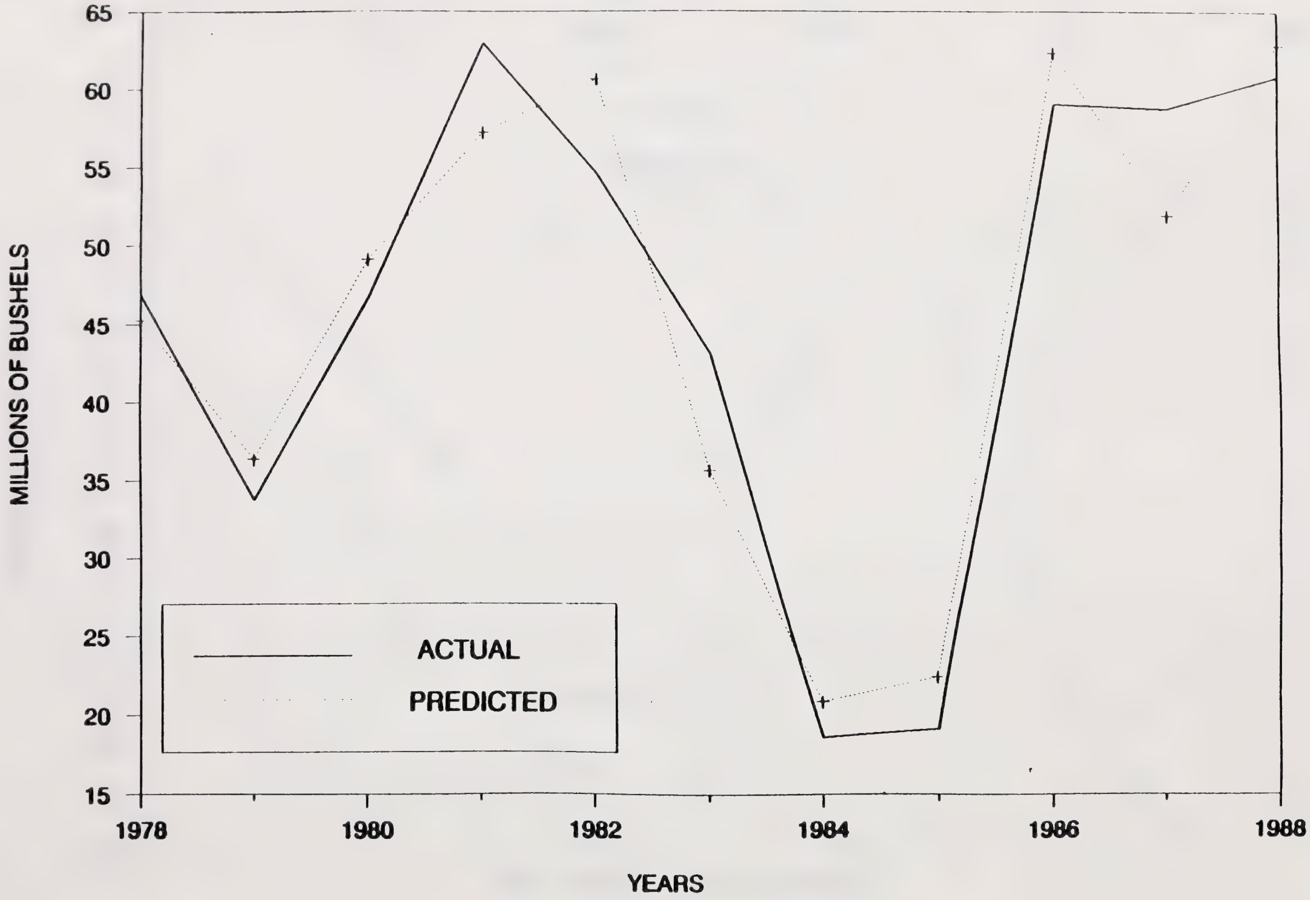
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), BARLEY - REGION 2



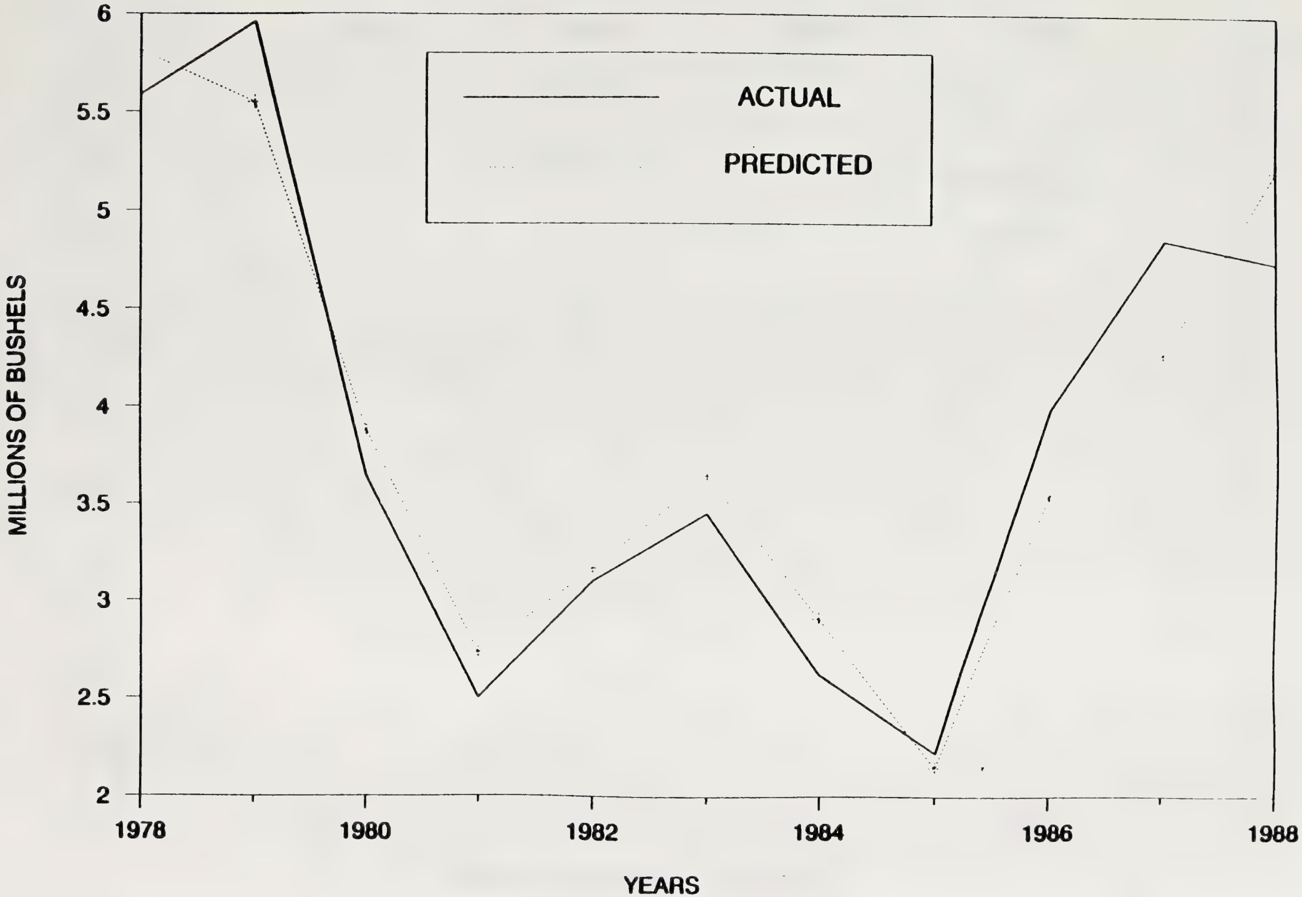
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), BARLEY - REGION 3



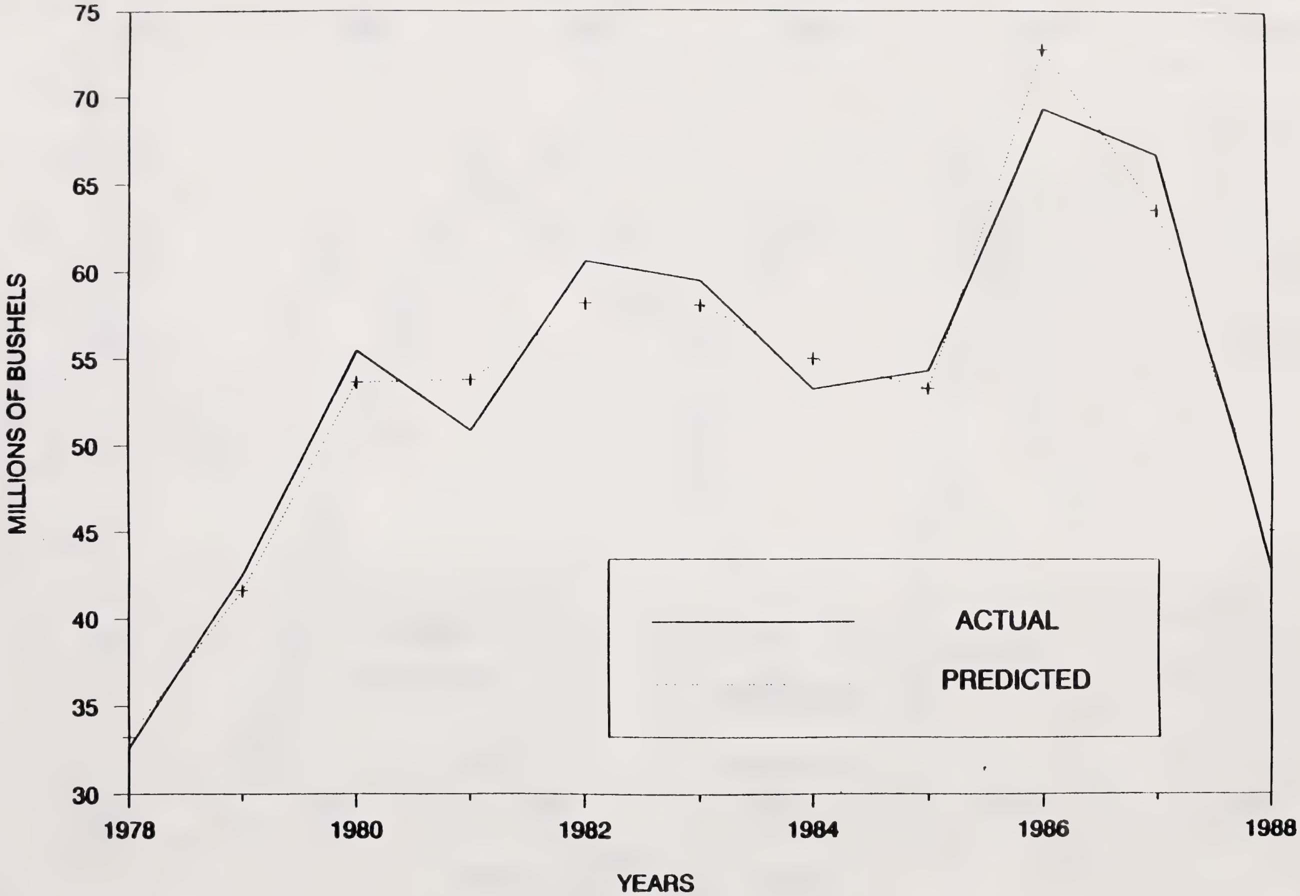
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), CANOLA - REGION 3



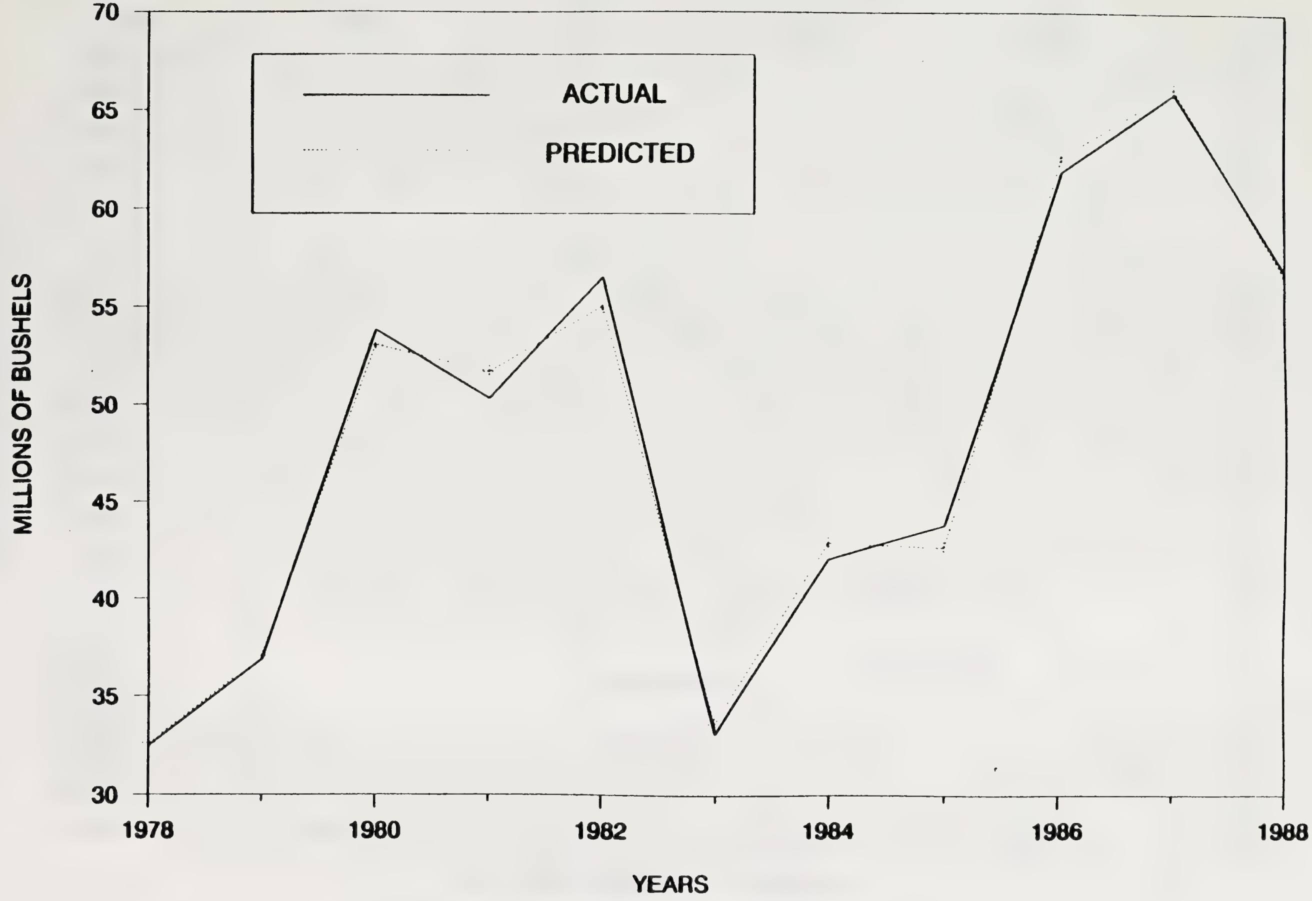
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), WHEAT - REGION 4



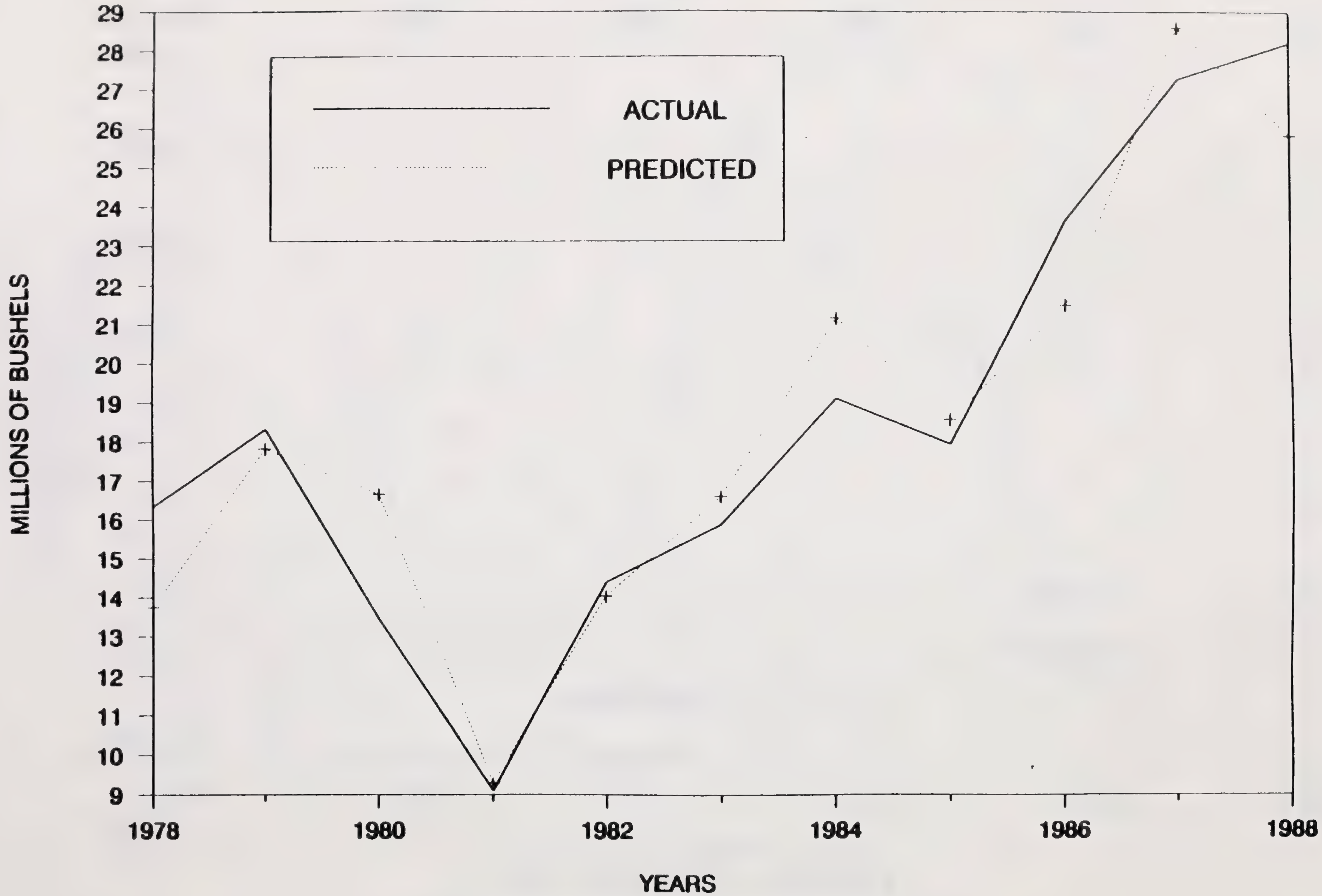
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), BARLEY - REGION 4



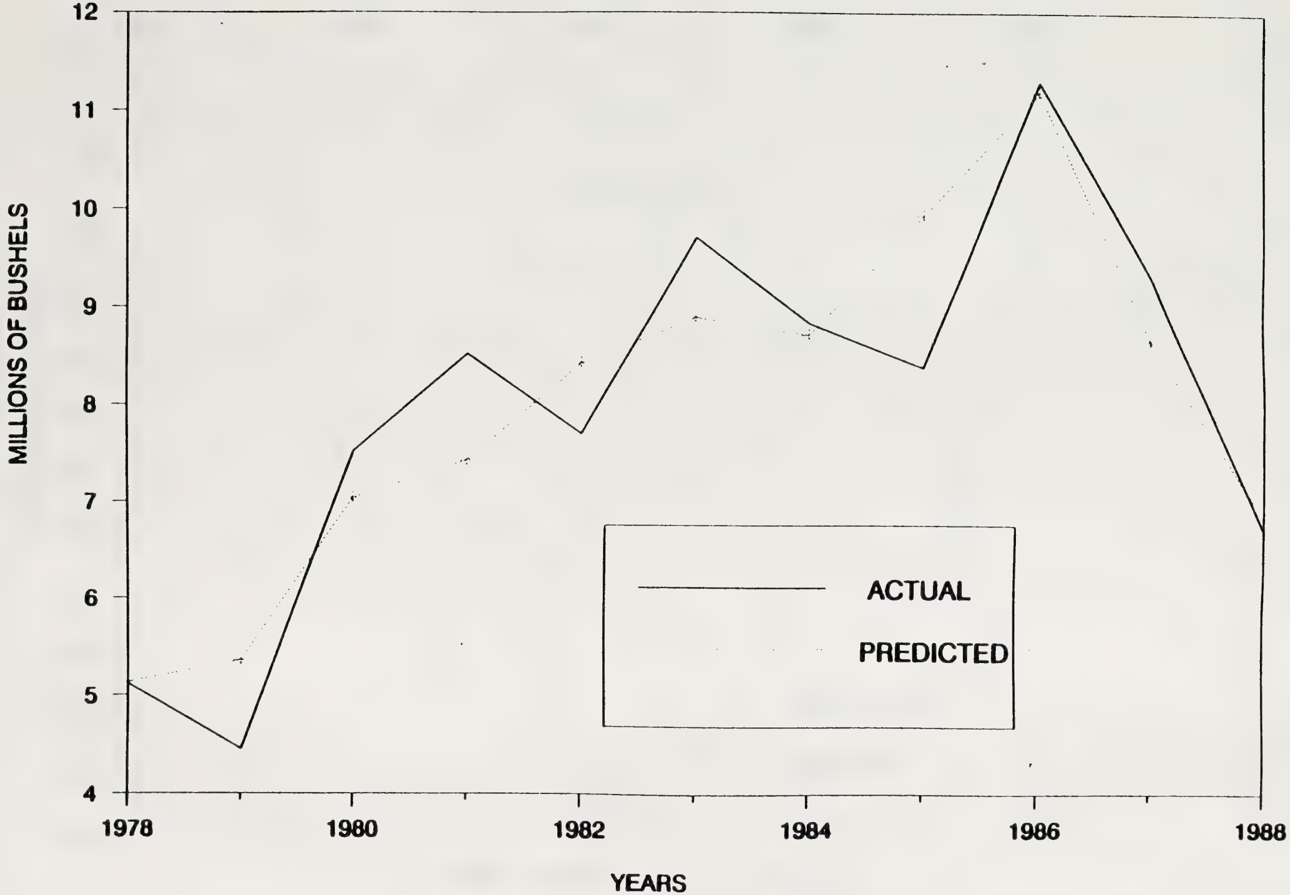
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), CANOLA - REGION 4



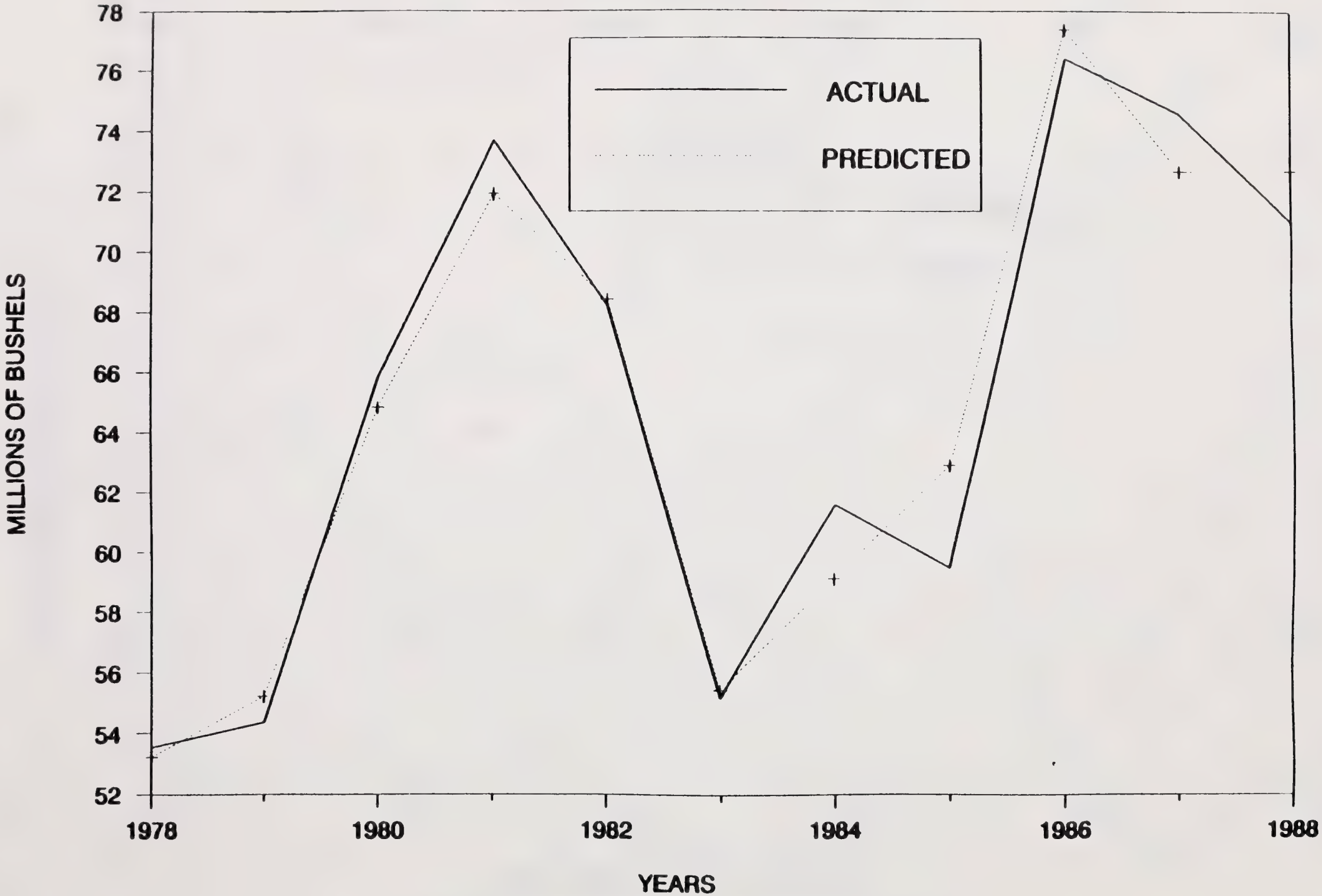
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), WHEAT - REGION 5

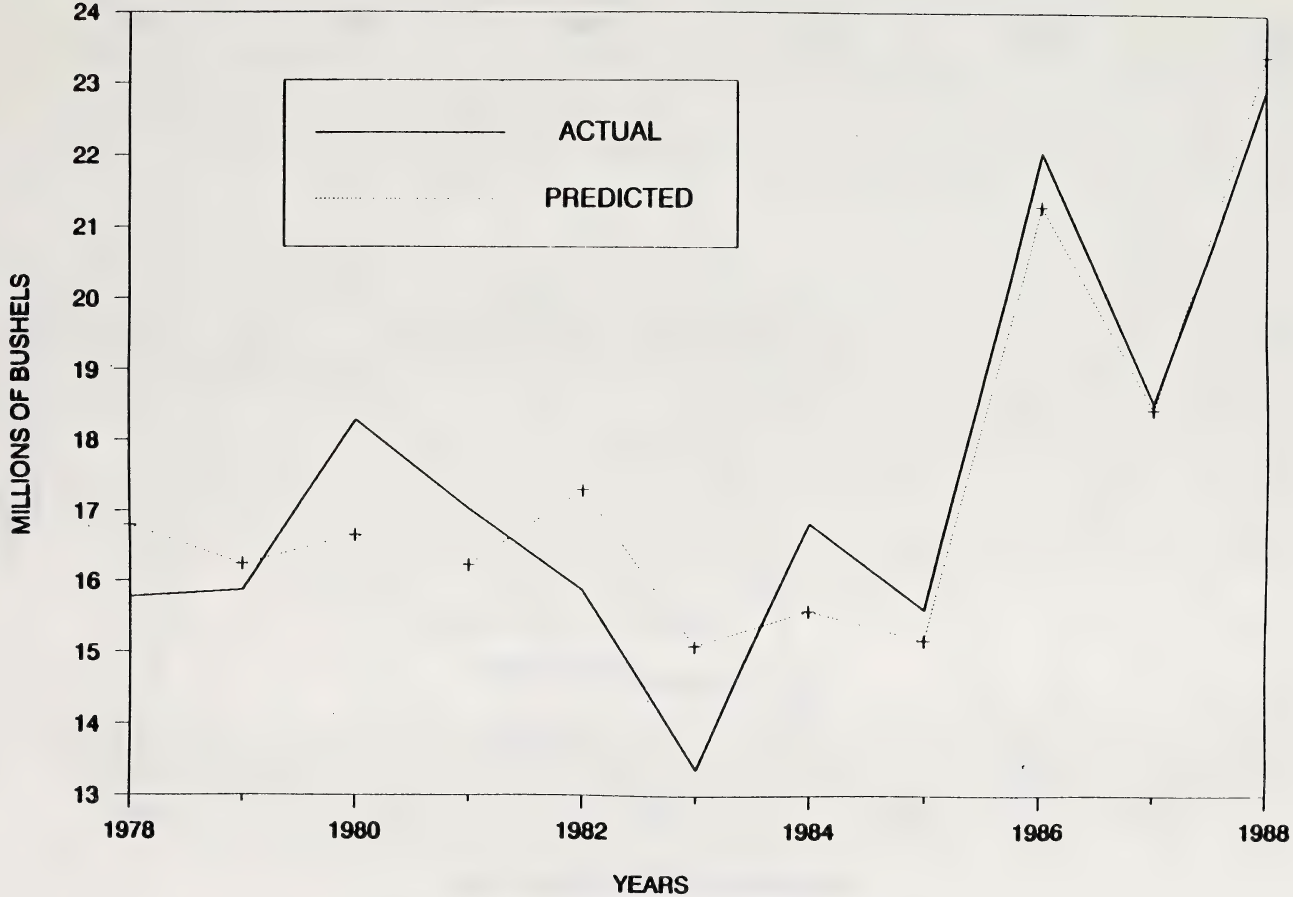


ACTUAL VERSUS PREDICTED PRODUCTION

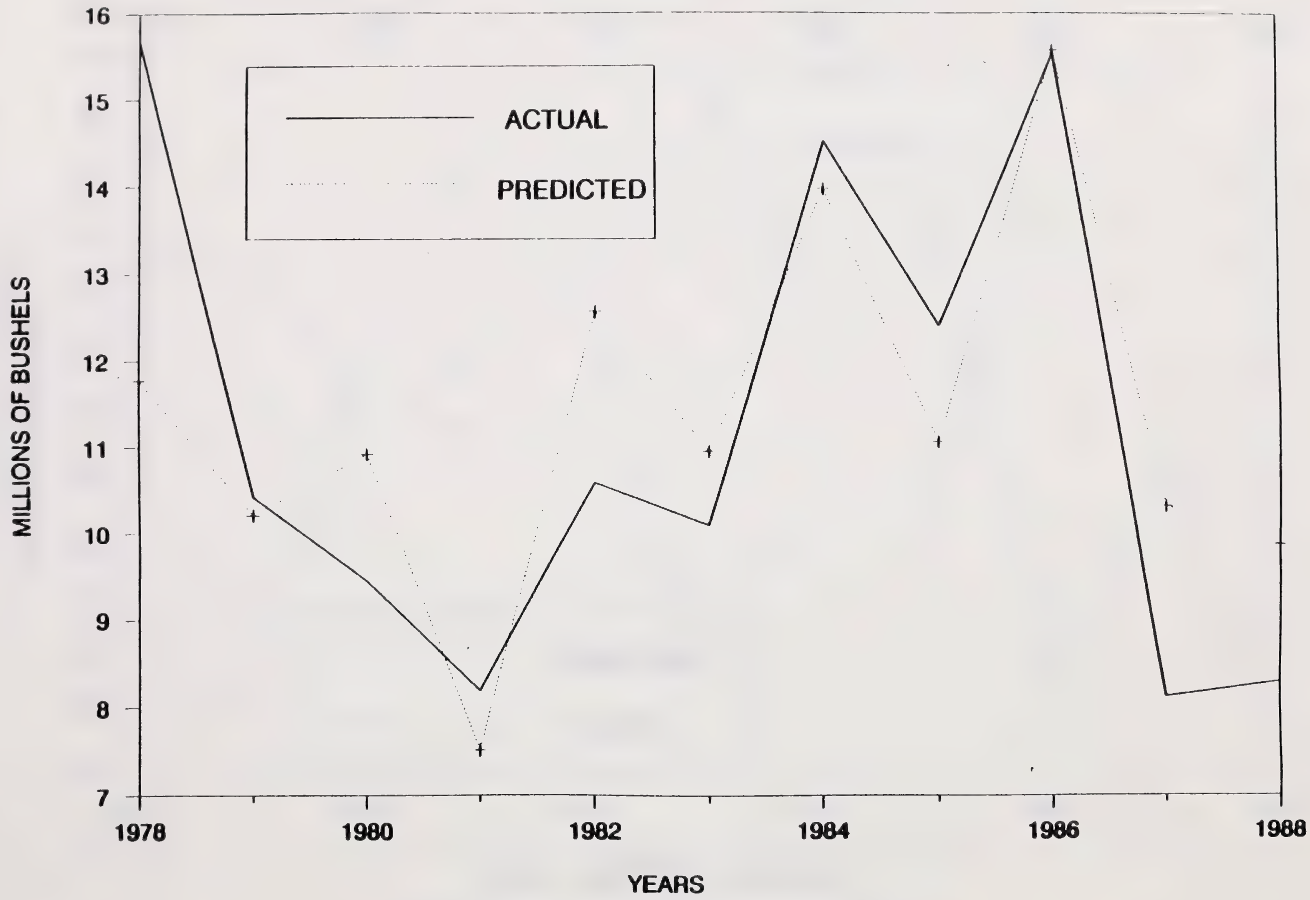
(1978 - 1988), BARLEY - REGION 5



ACTUAL VERSUS PREDICTED PRODUCTION
(1978 - 1988), OATS - REGION 5

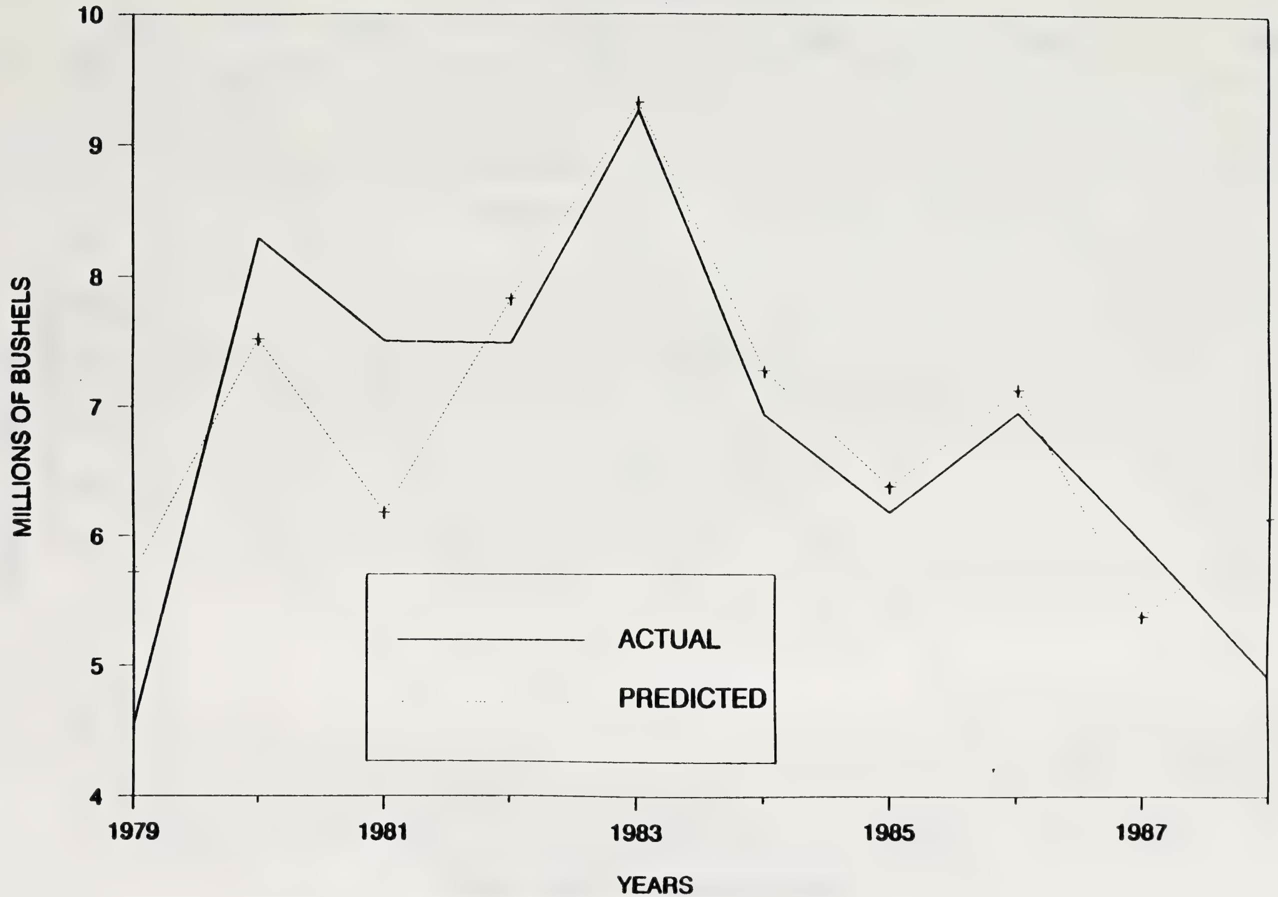


ACTUAL VERSUS PREDICTED PRODUCTION
(1978 - 1988), CANOLA - REGION 5



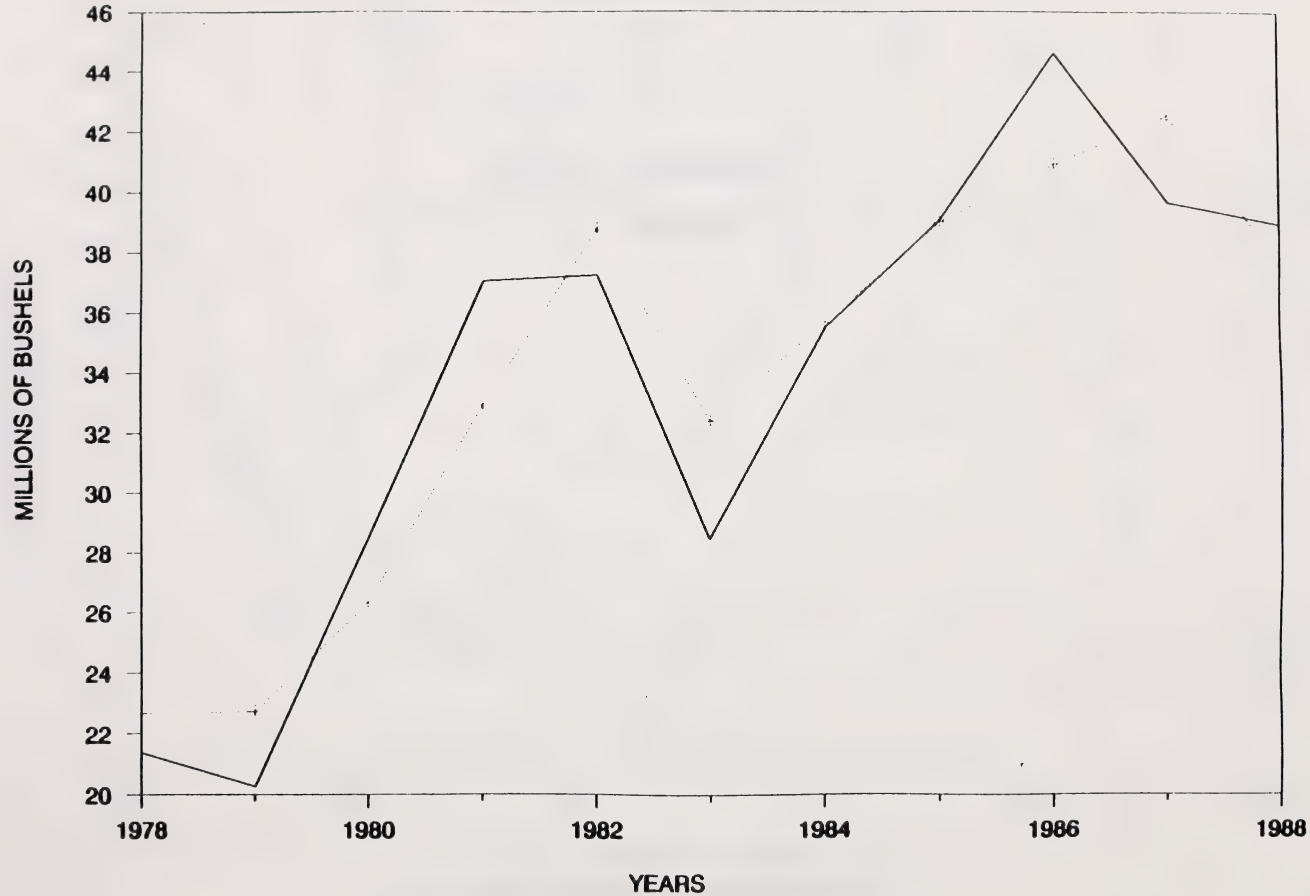
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), WHEAT - REGION 6



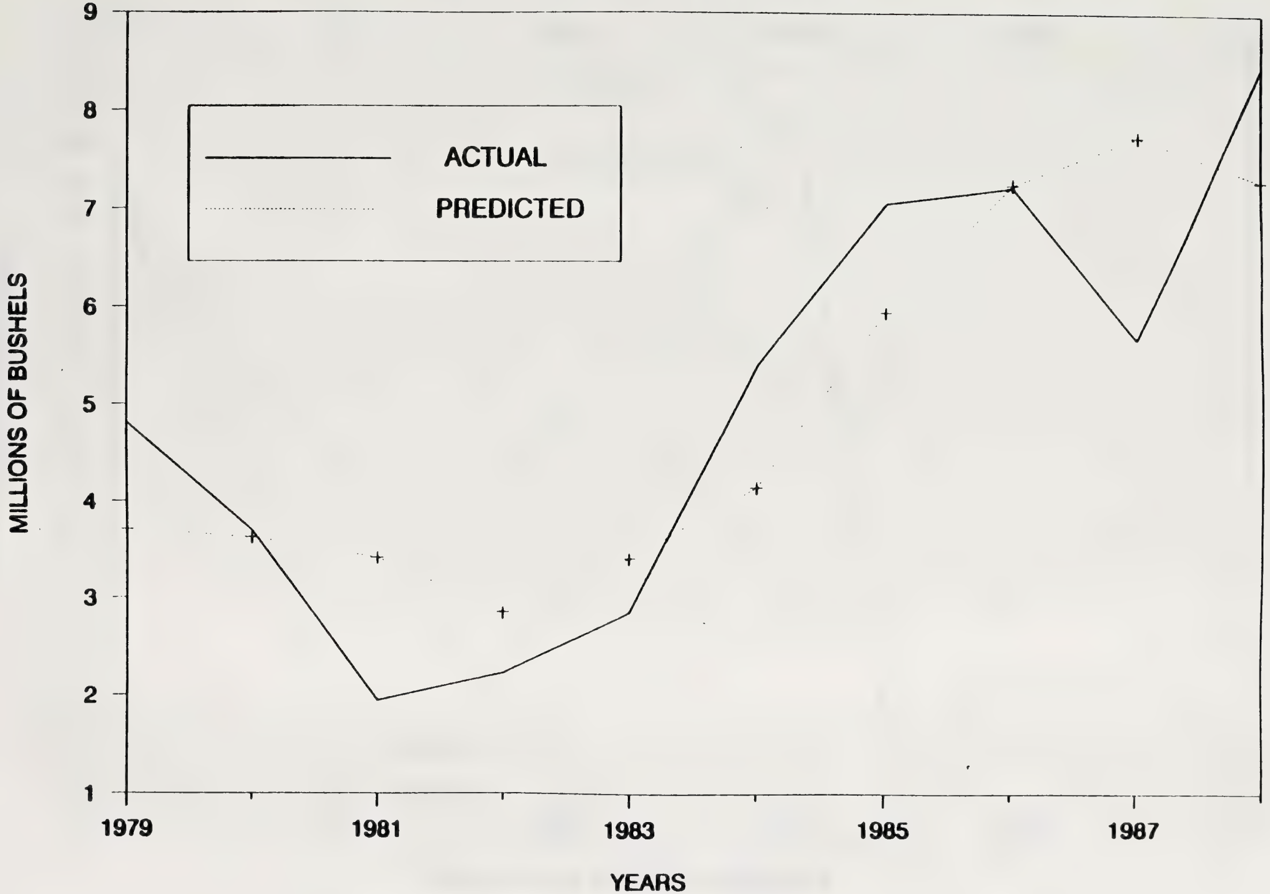
ACTUAL VERSUS PREDICTED PRODUCTION

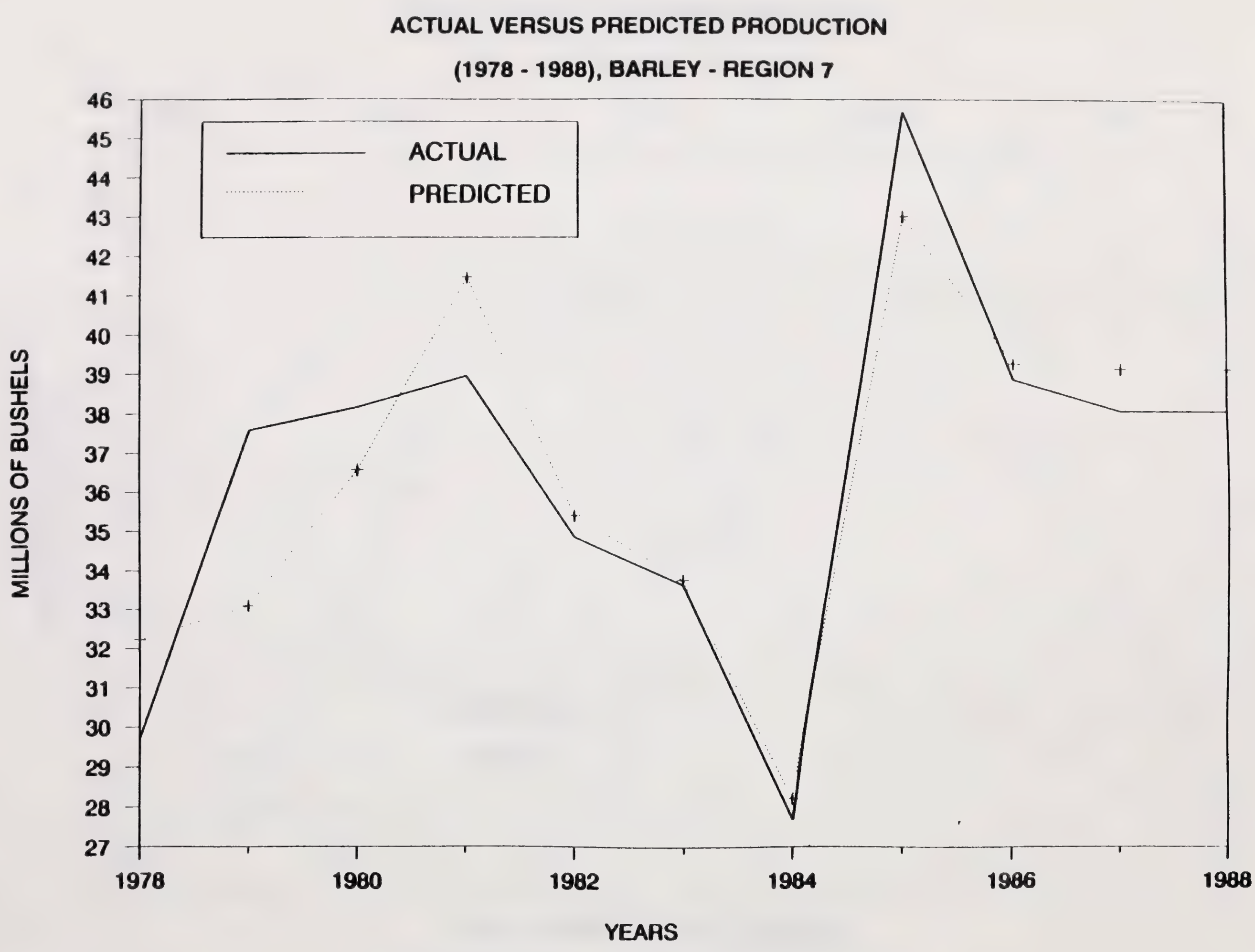
(1978 - 1988), BARLEY - REGION 6



ACTUAL VERSUS PREDICTED PRODUCTION

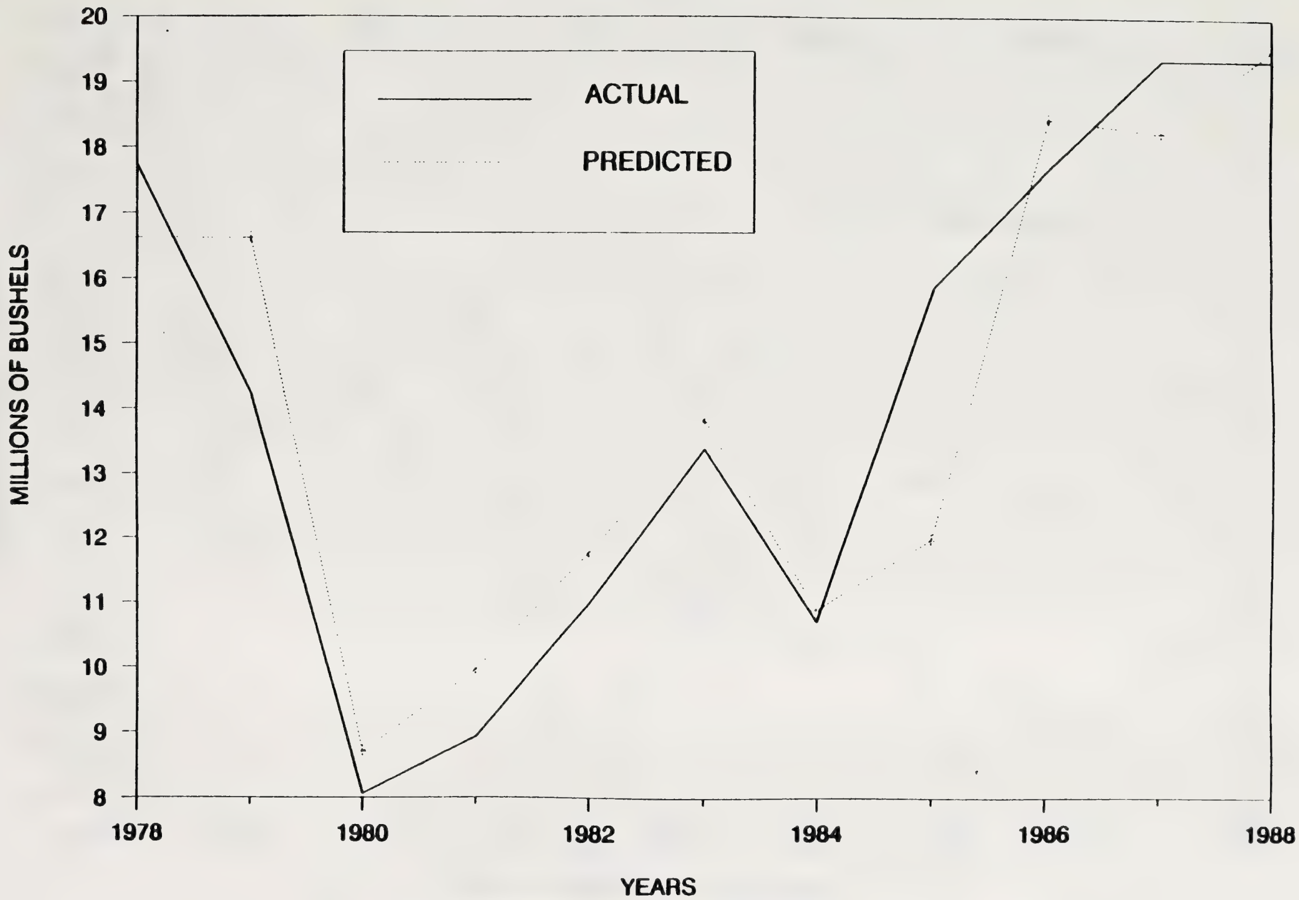
(1978 - 1988), CANOLA - REGION 6




ACTUAL VERSUS PREDICTED PRODUCTION
(1978 - 1988), BARLEY - REGION 7
ACTUAL
PREDICTED
MILLIONS OF BUSHELS
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
1978
1980
1982
1984
1986
1988
YEARS

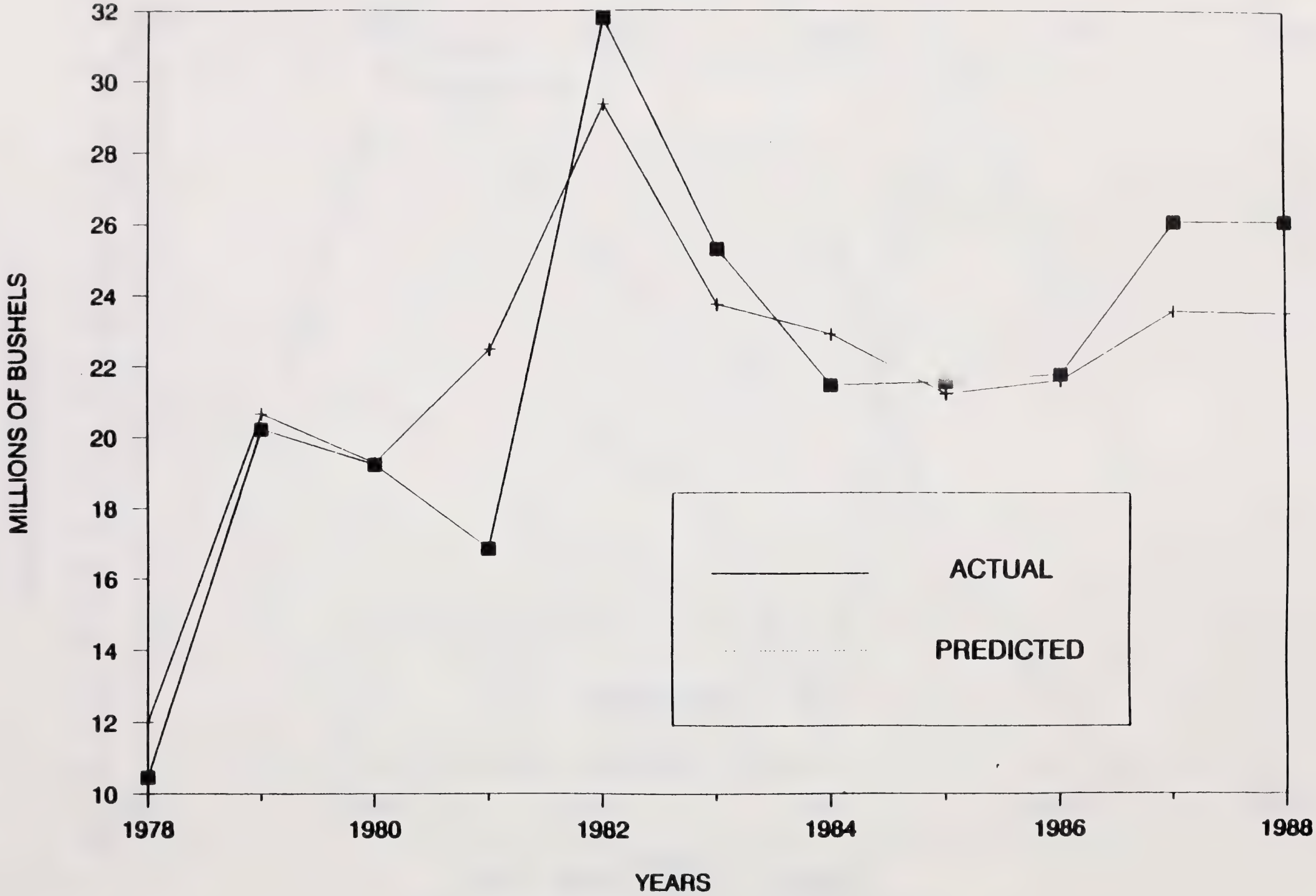
ACTUAL VERSUS PREDICTED PRODUCTION

(1978 - 1988), CANOLA - REGION 7

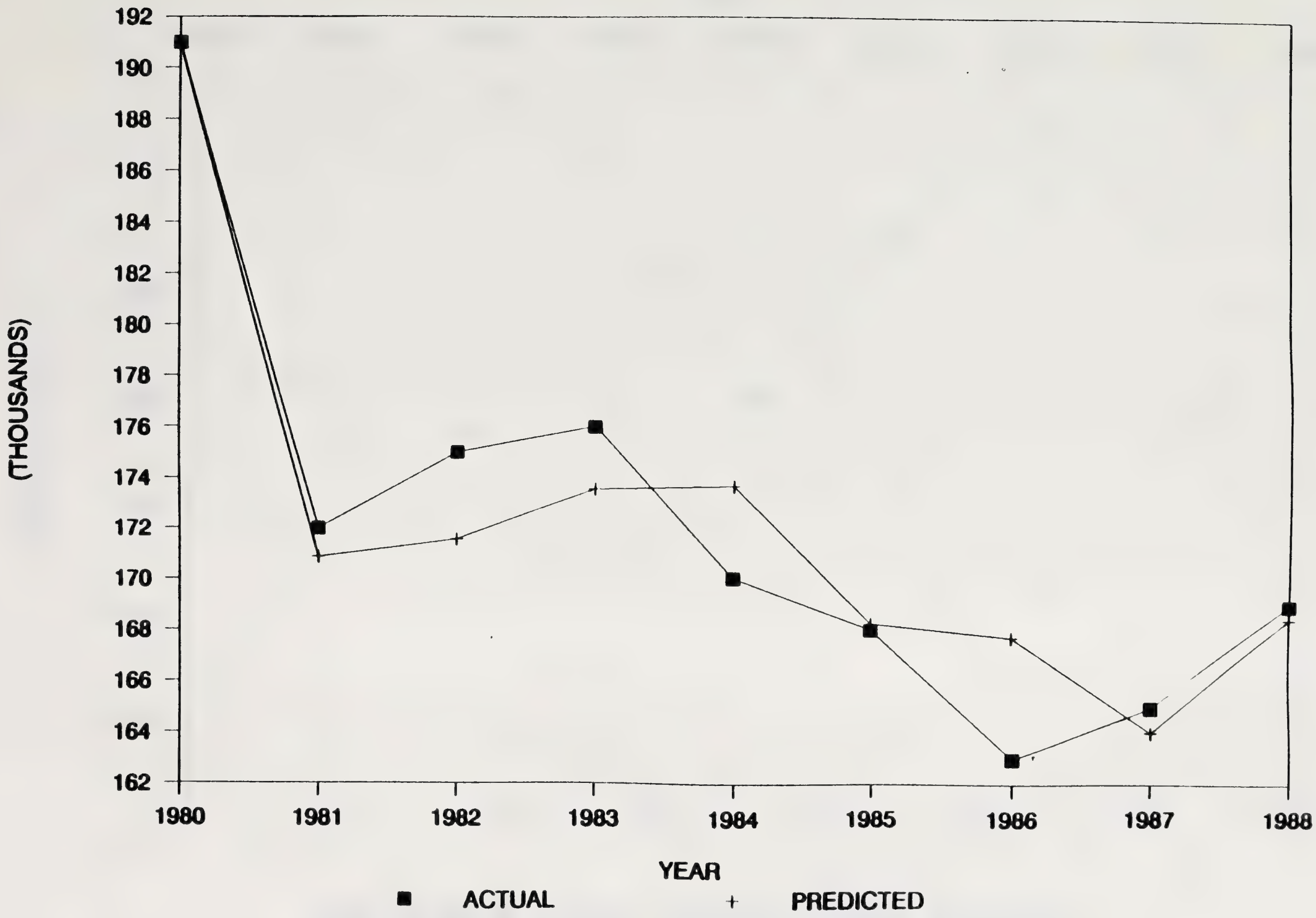


ACTUAL VERSUS PREDICTED PRODUCTION

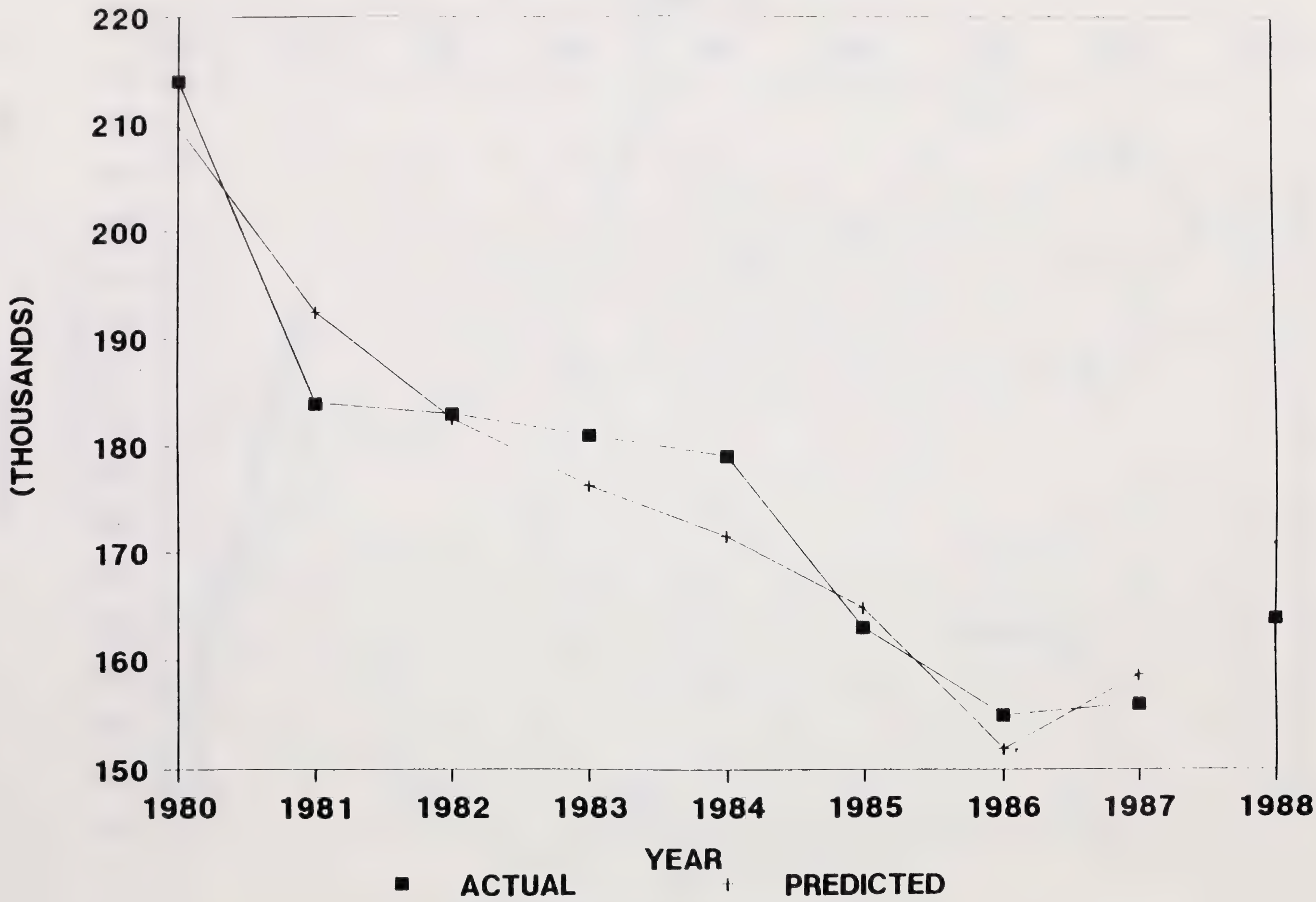
(1978 - 1988), WHEAT - REGION 7



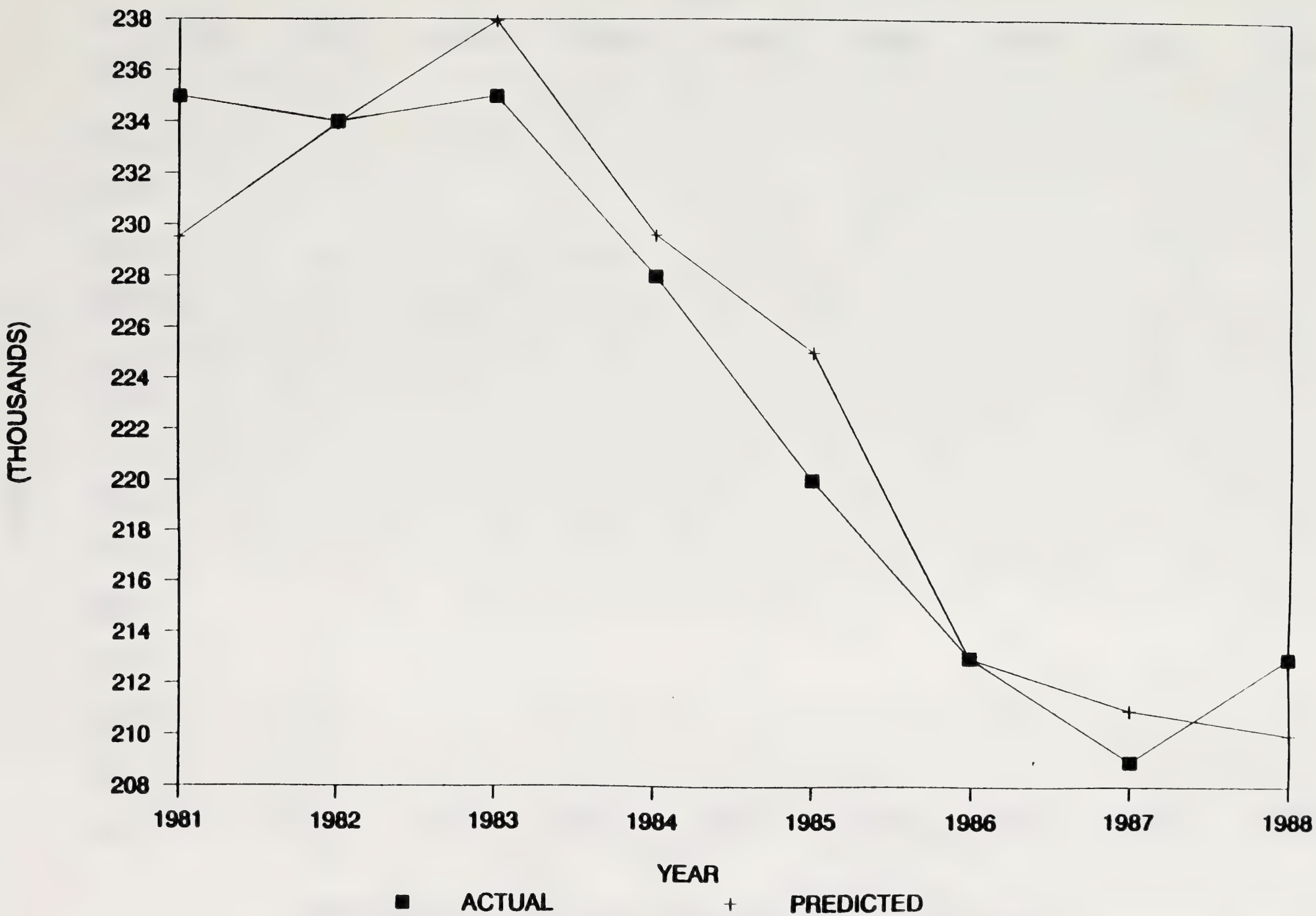
REGION I COW INVENTORY MODEL



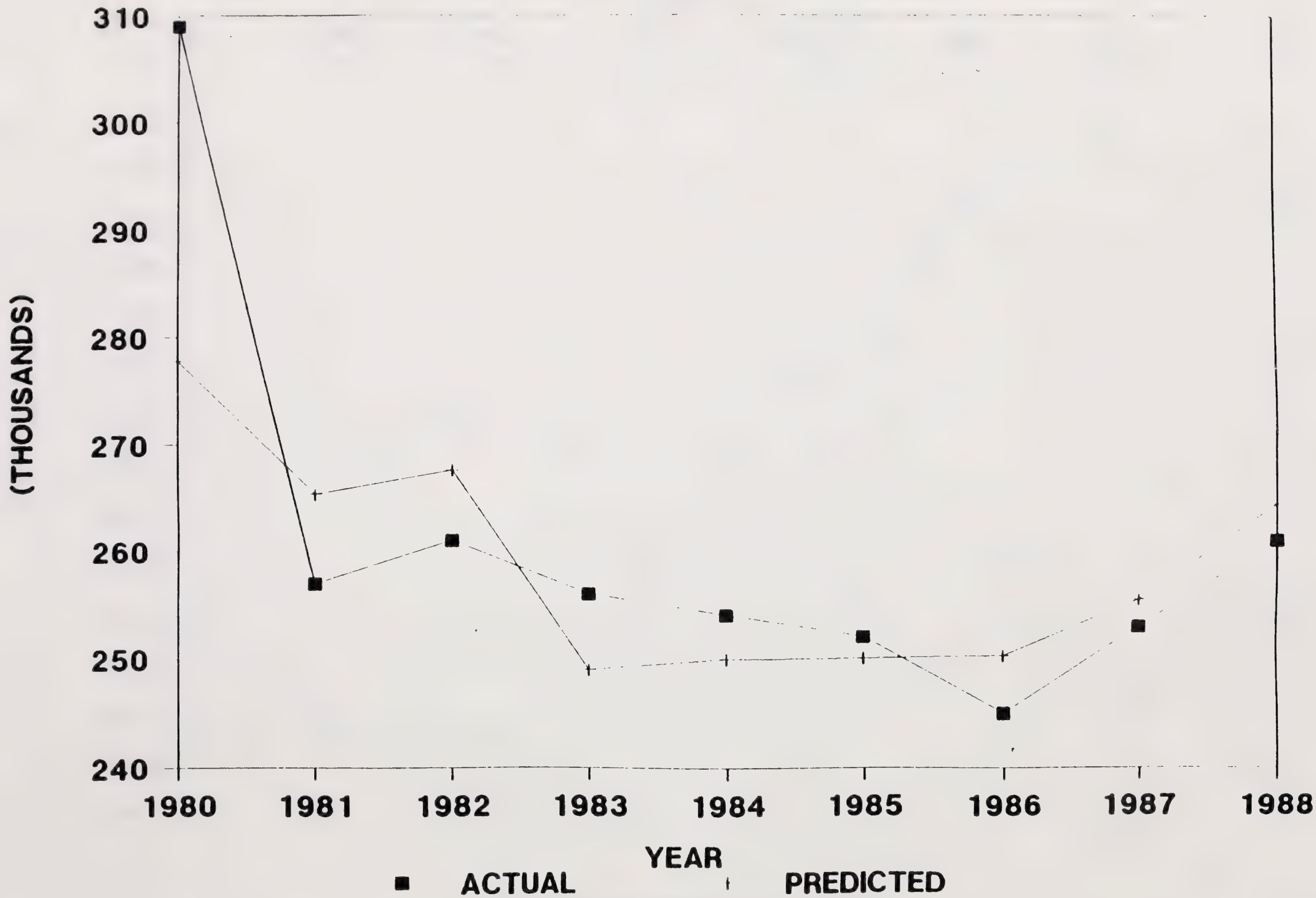
REGION II COW INVENTORY MODEL



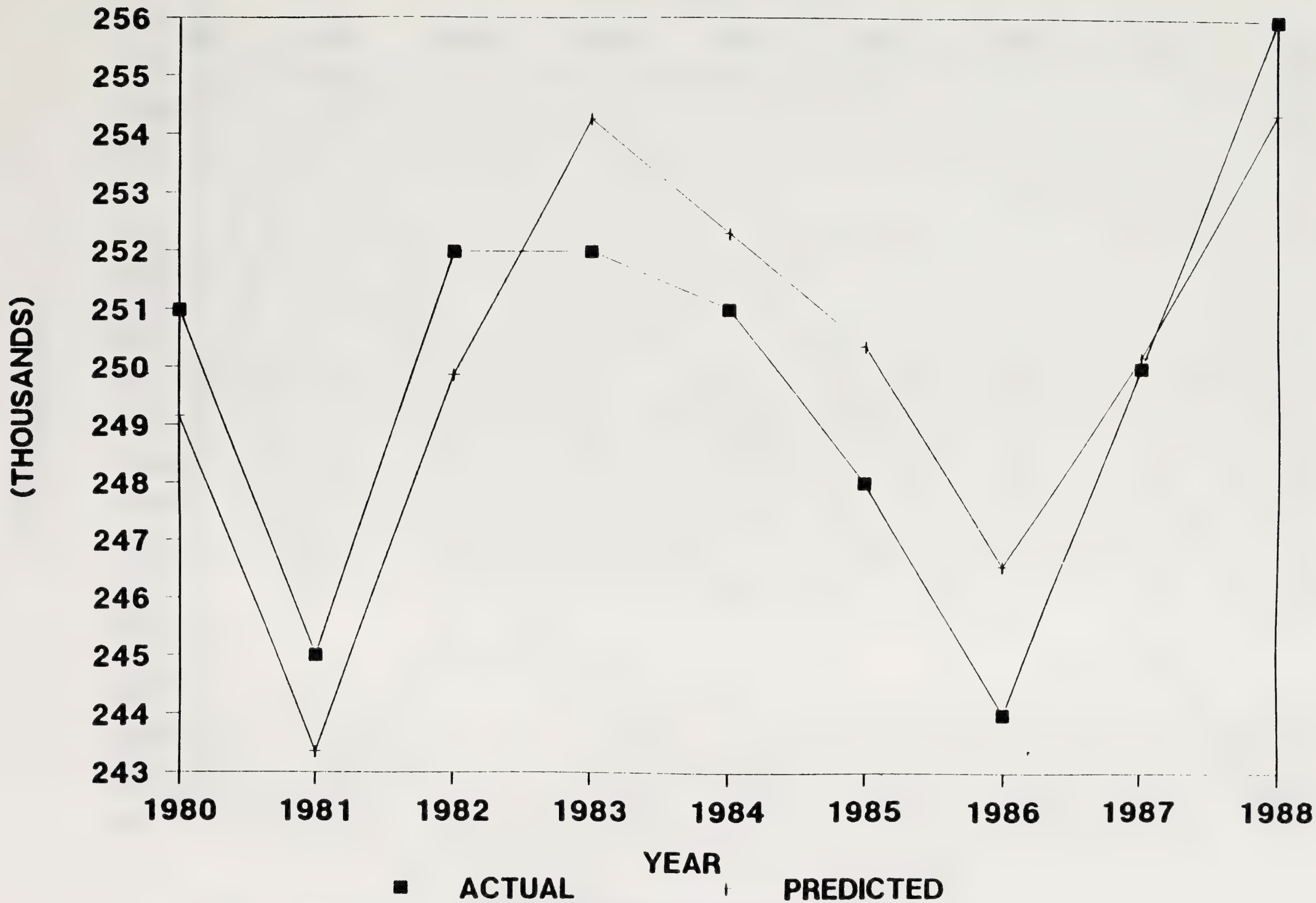
REGION III COW INVENTORY MODEL



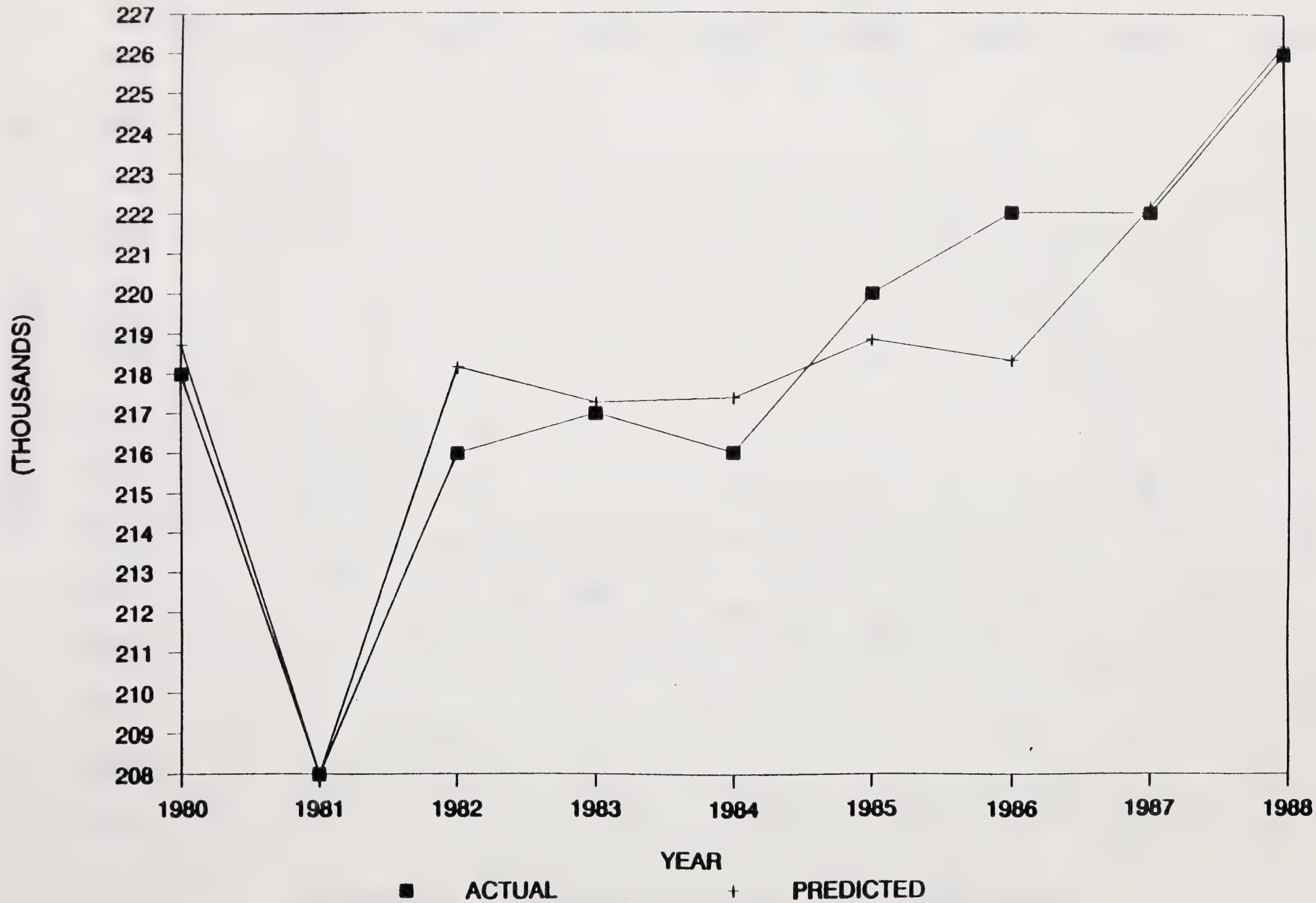
REGION IV COW INVENTORY MODEL



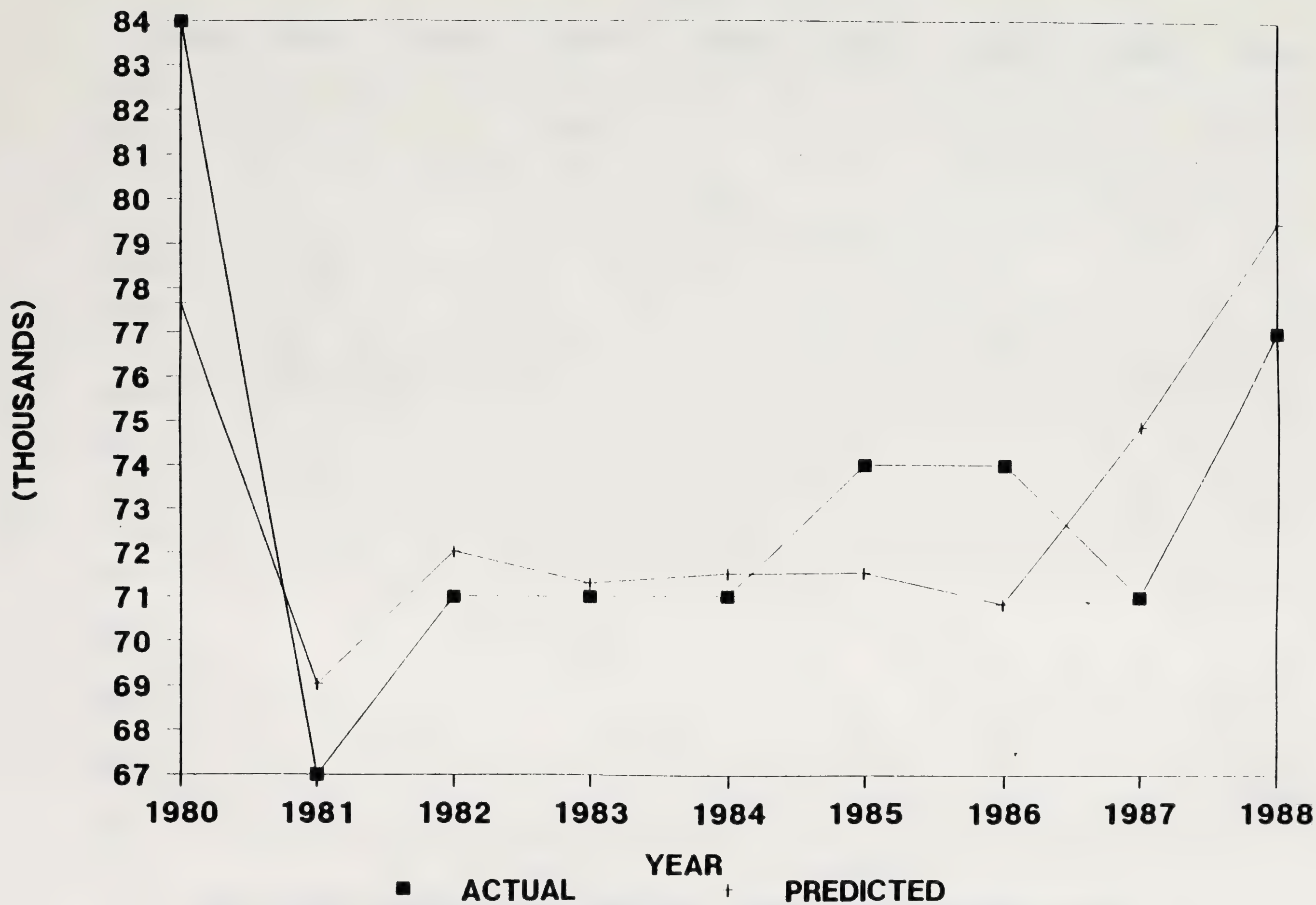
REGION V COW INVENTORY MODEL



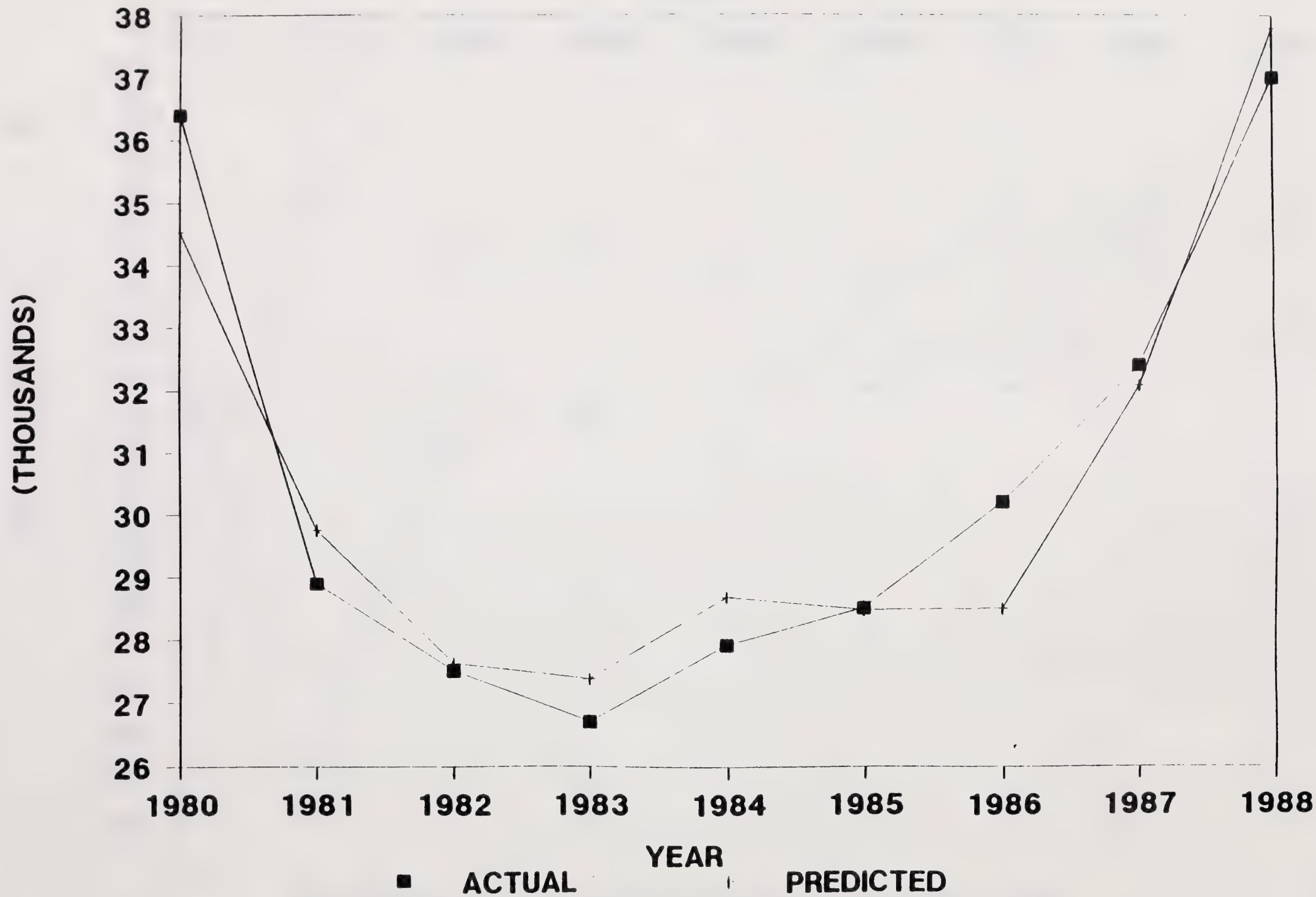
REGION VI COW INVENTORY MODEL



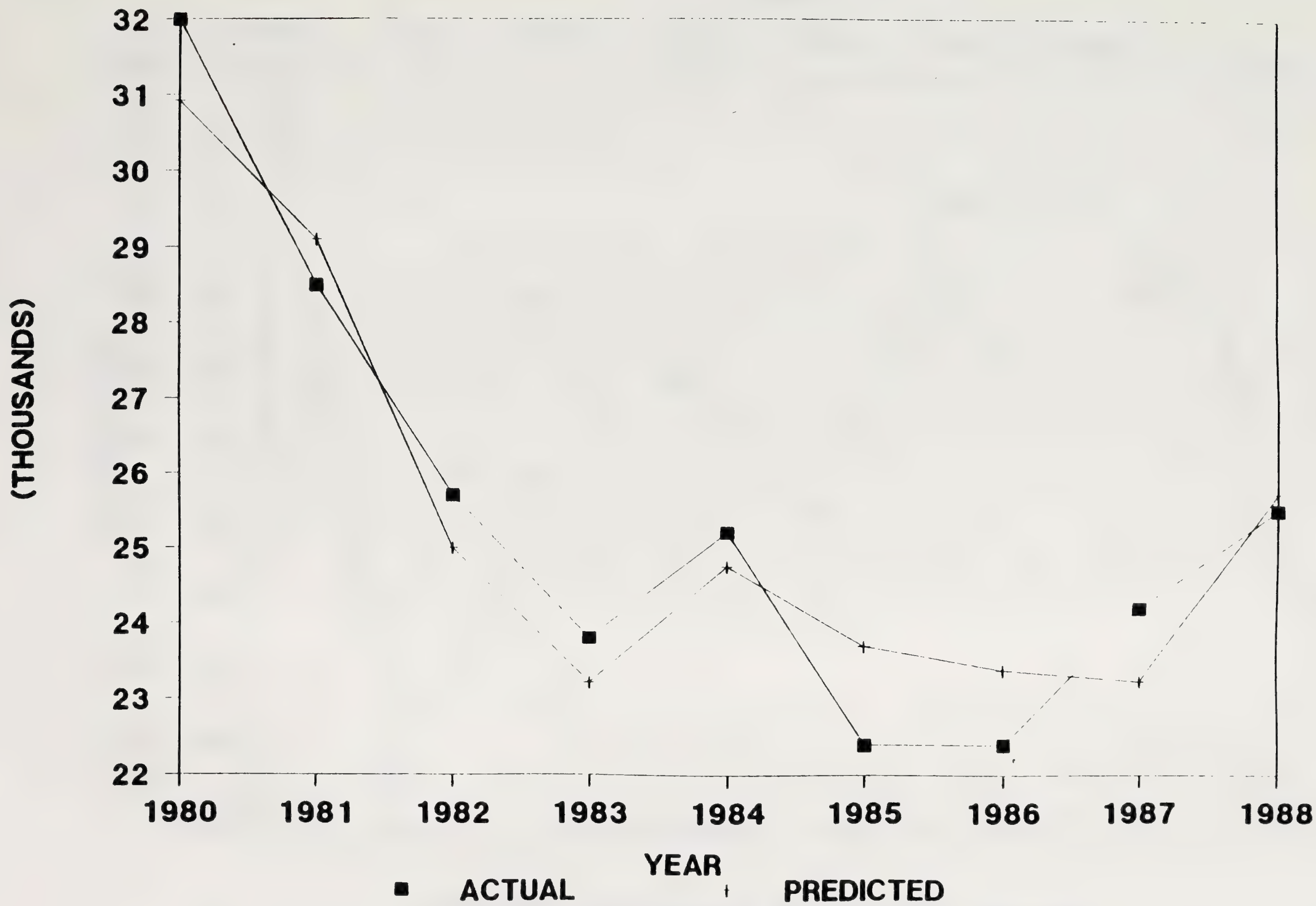
REGION VII COW INVENTORY MODEL



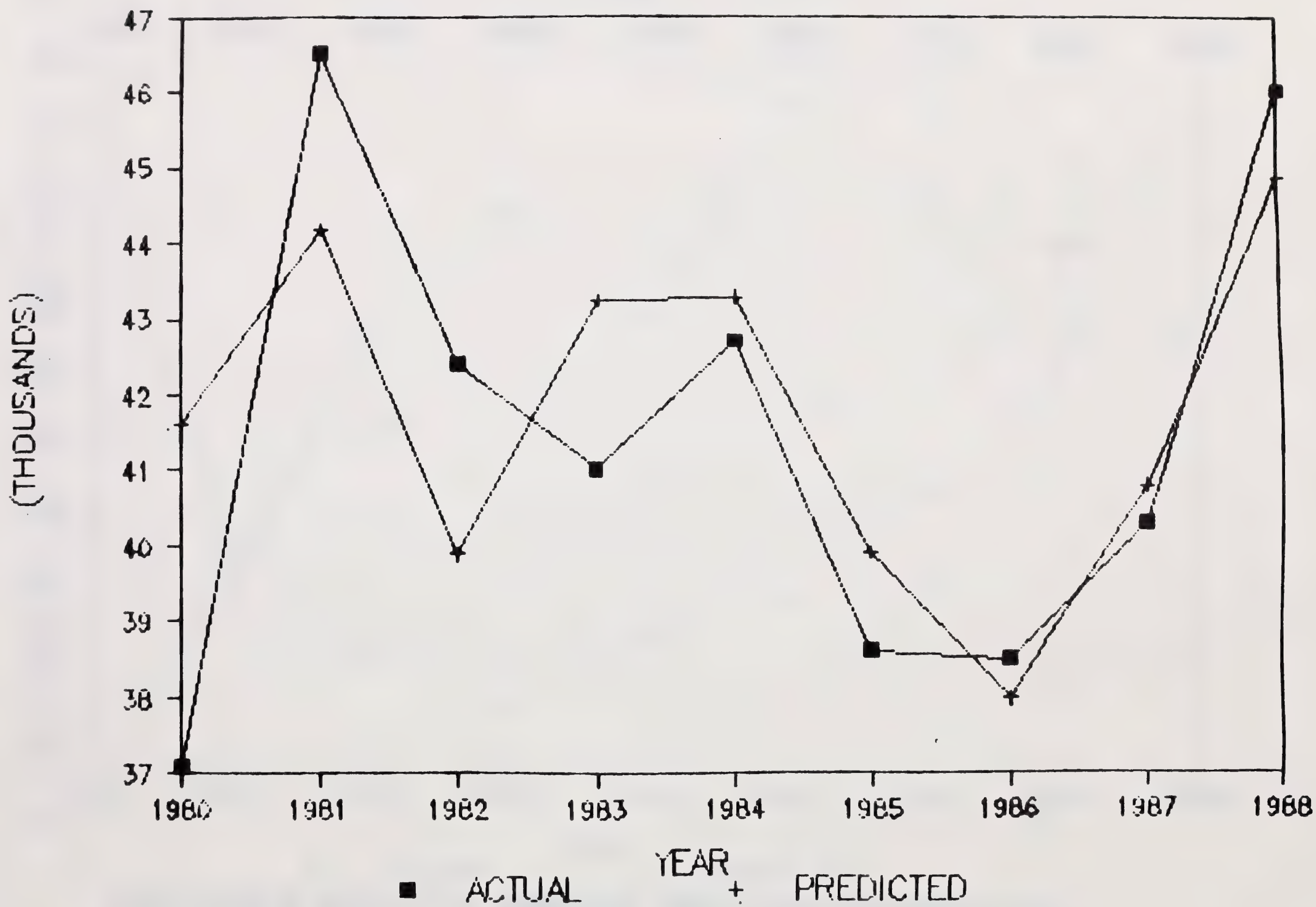
REGION I REPLACEMENT HEIFER INVENTORY



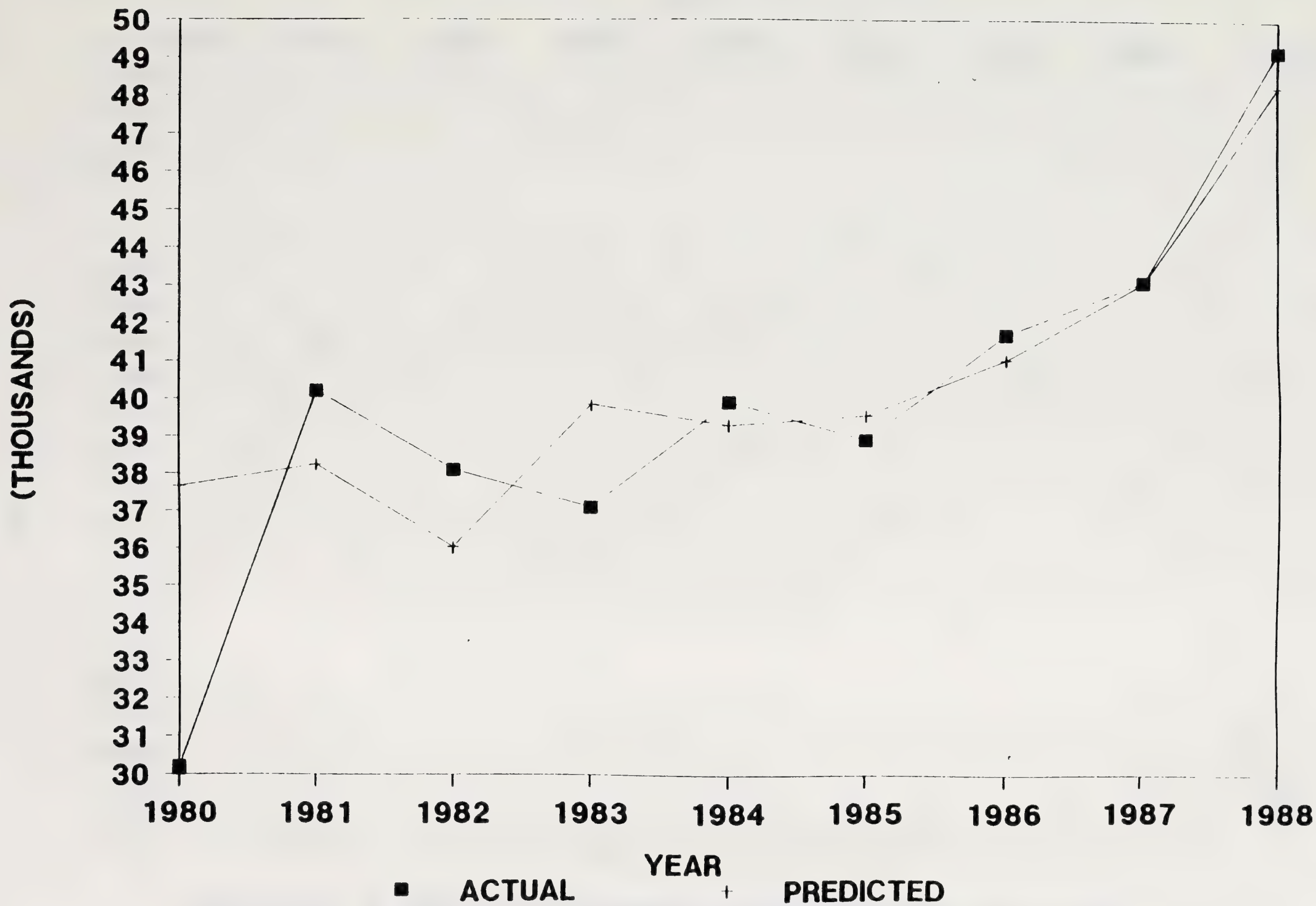
REGION II REPLACEMENT HEIFER INVENTORY



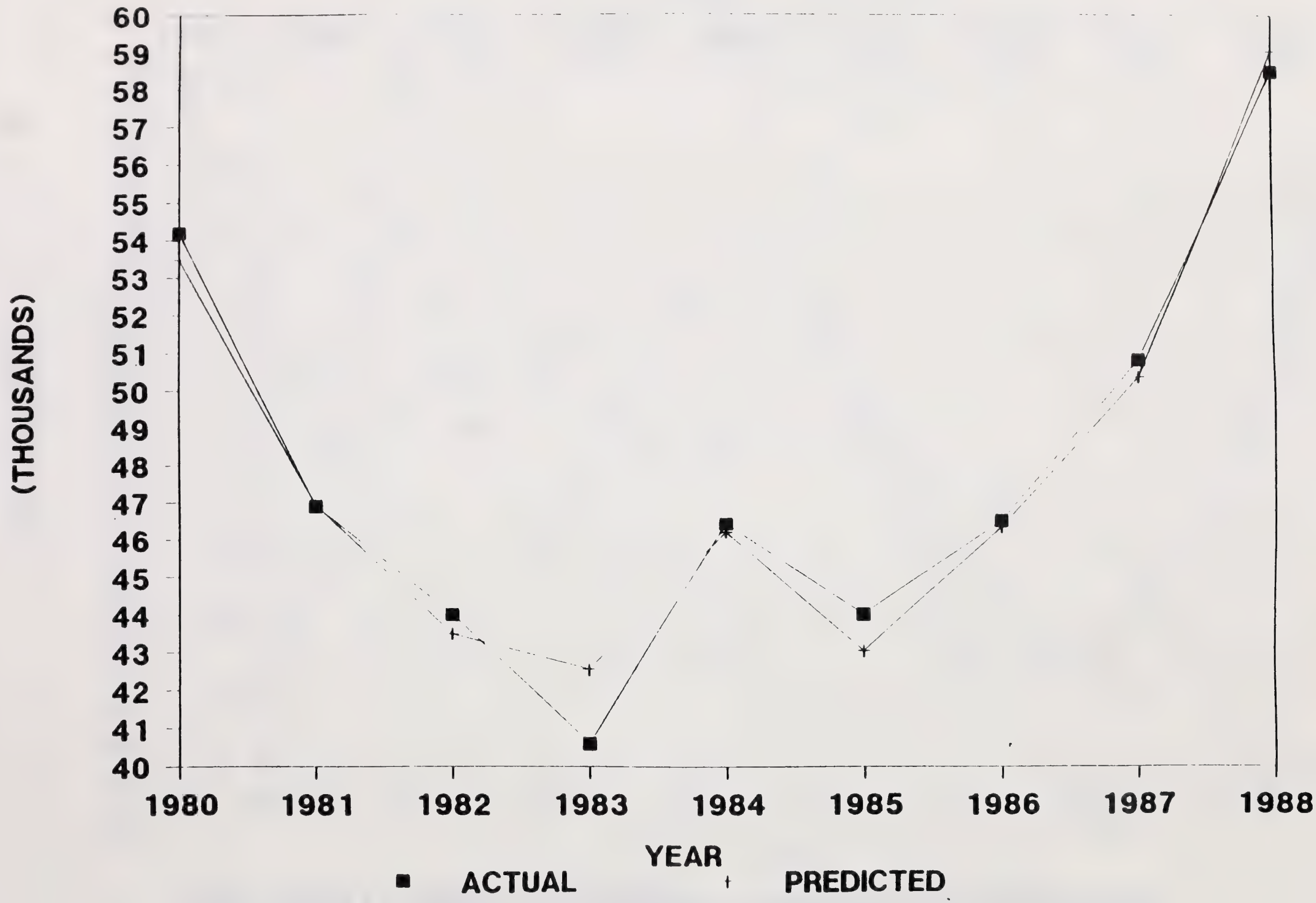
REGION III HEIFER INVENTORY MODEL



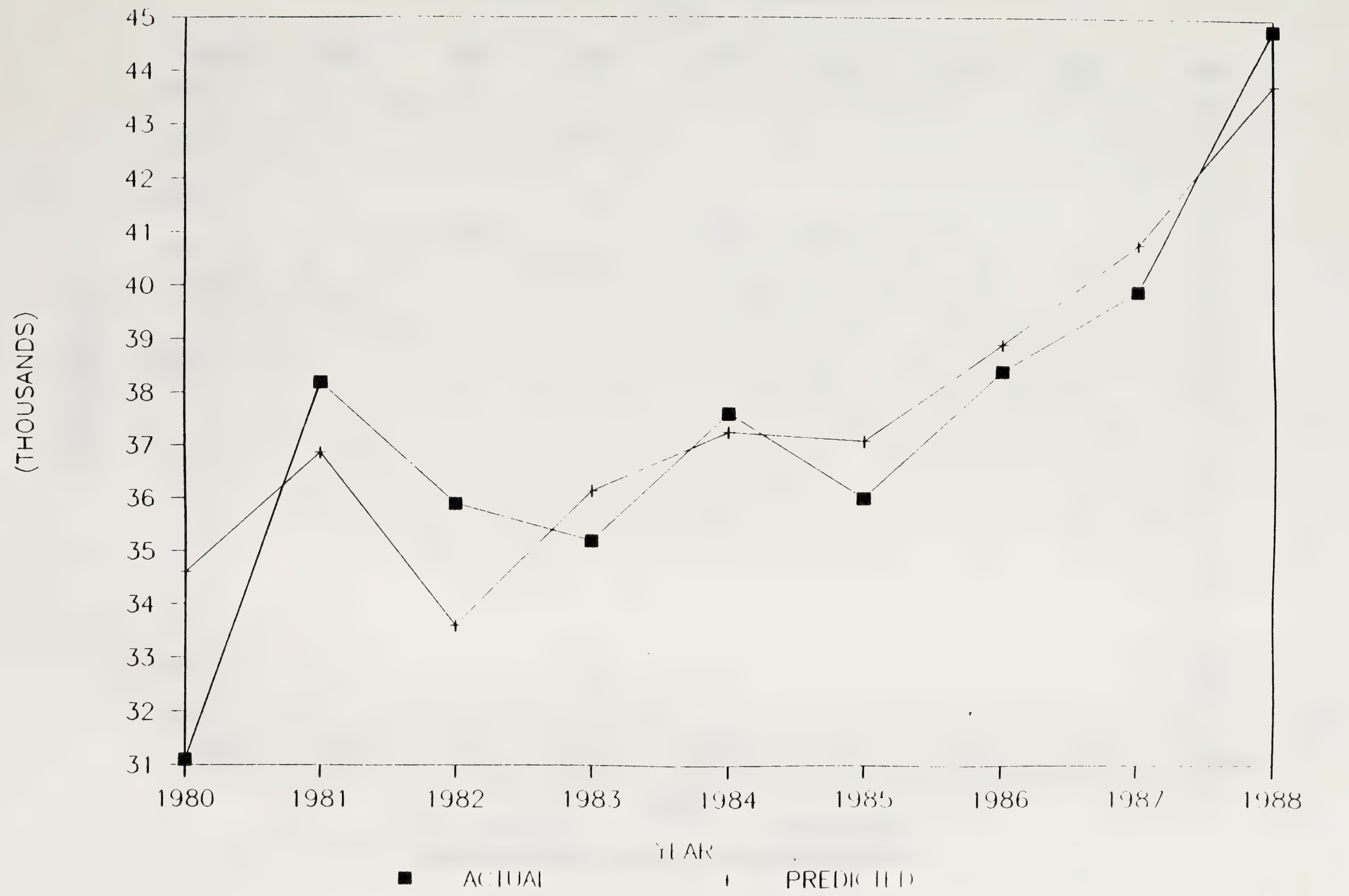
REGION IV REPLACEMENT HEIFER INVENTORY

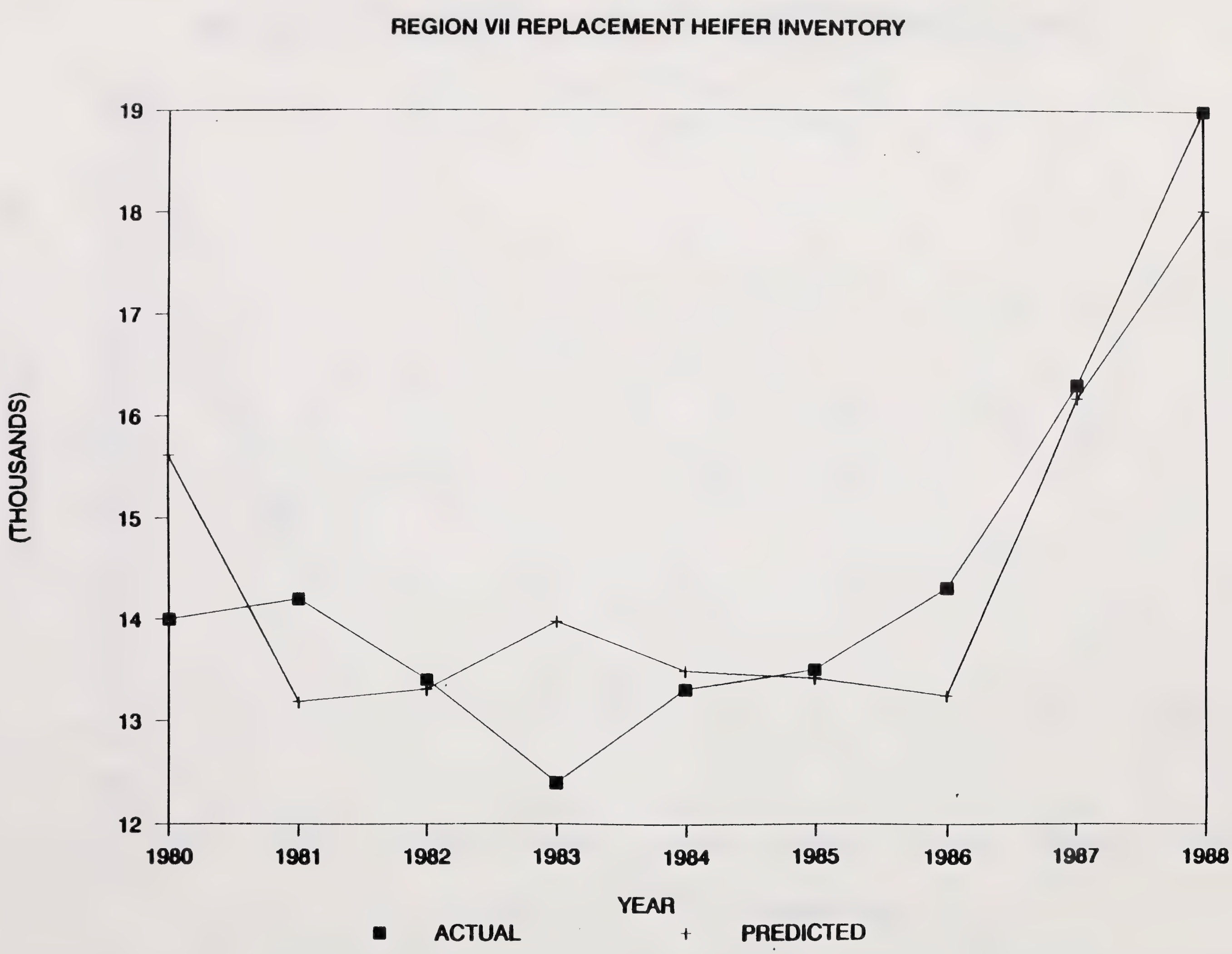


REGION V REPLACEMENT HEIFER INVENTORY

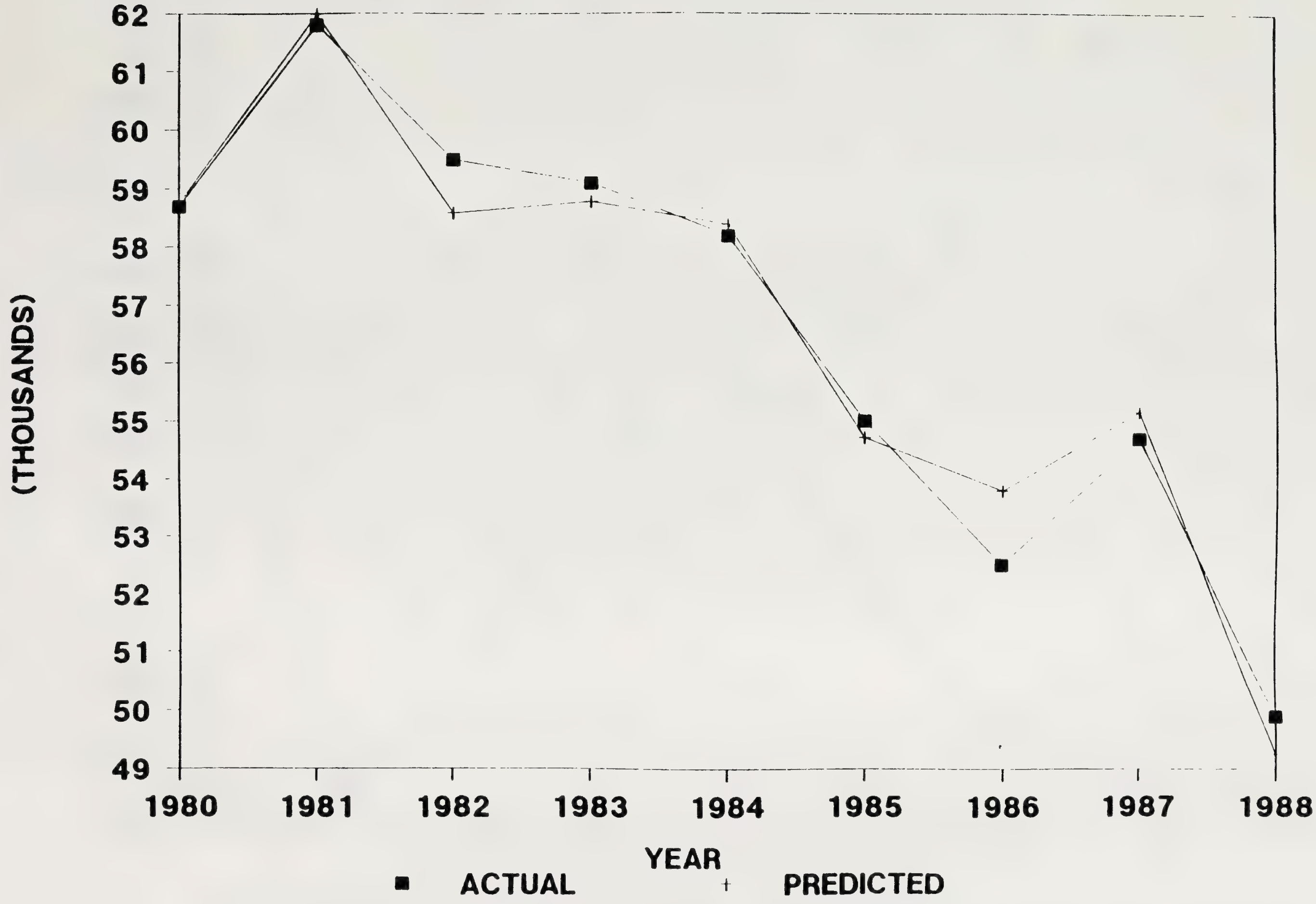


REGION VI REPLACEMENT HEIFER INVENTORY

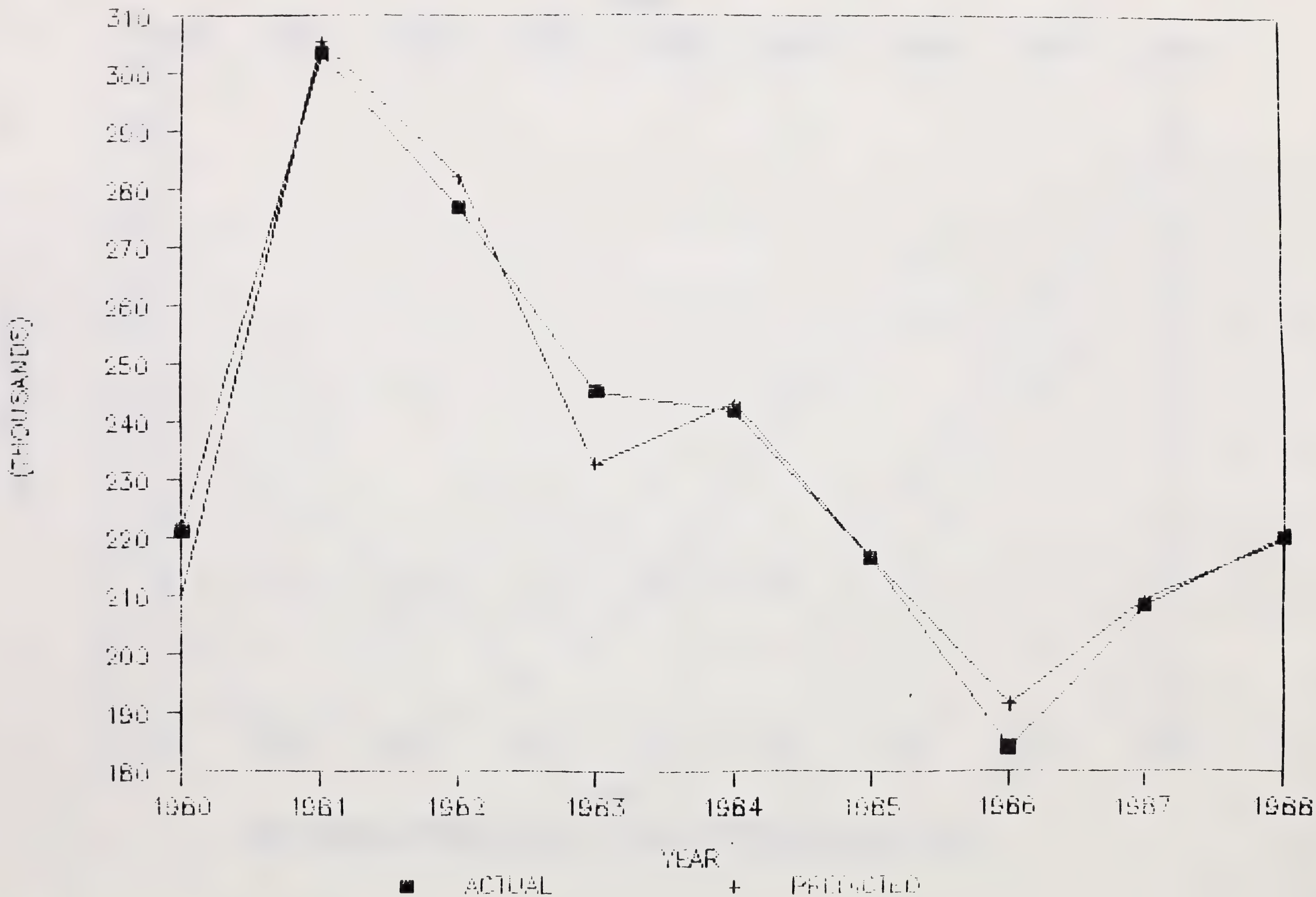



REGION VII REPLACEMENT HEIFER INVENTORY
(THOUSANDS)
19
18
17
16
15
14
13
12
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR
ACTUAL
PREDICTED

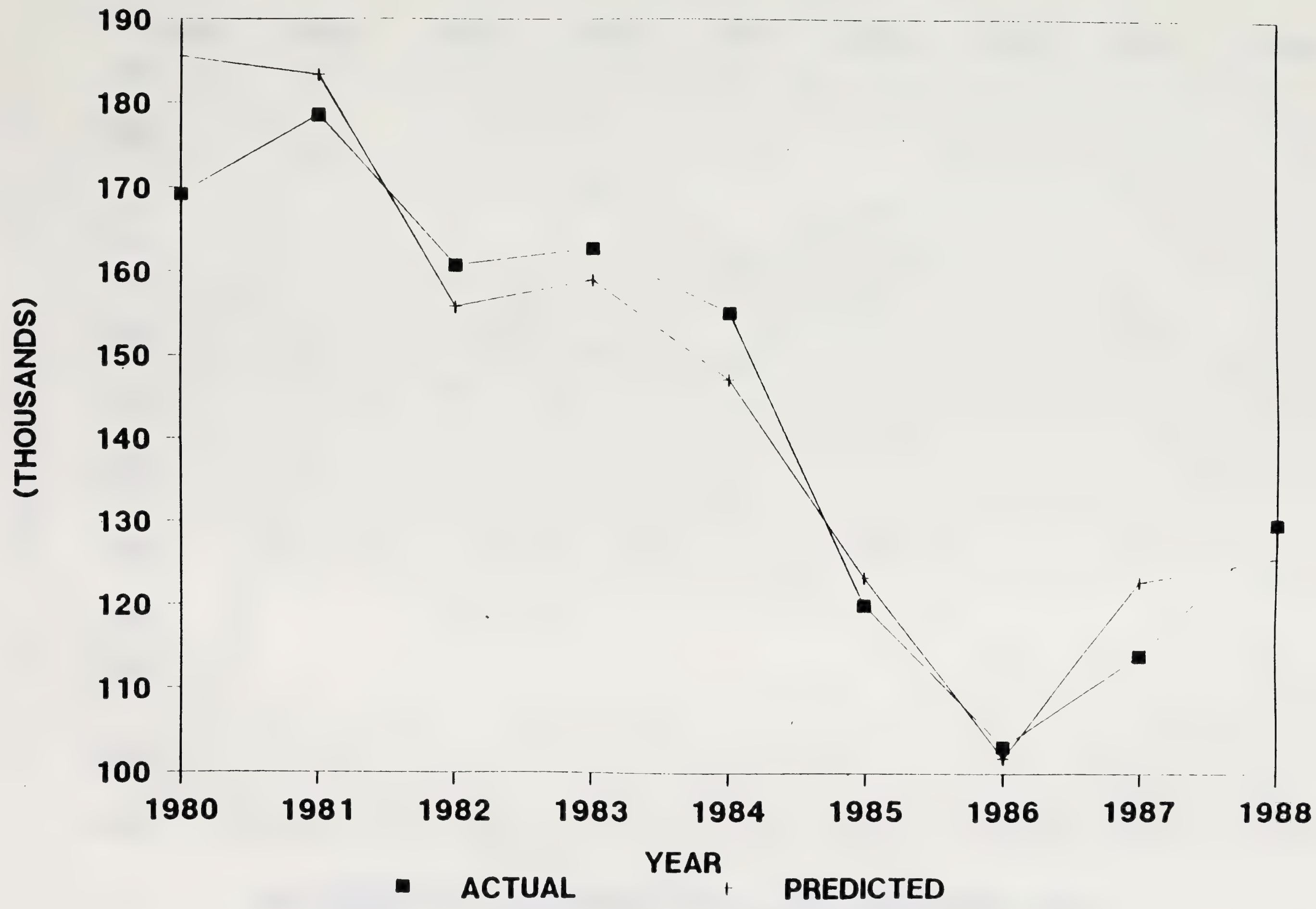
REGION I FEEDER CATTLE INVENTORY



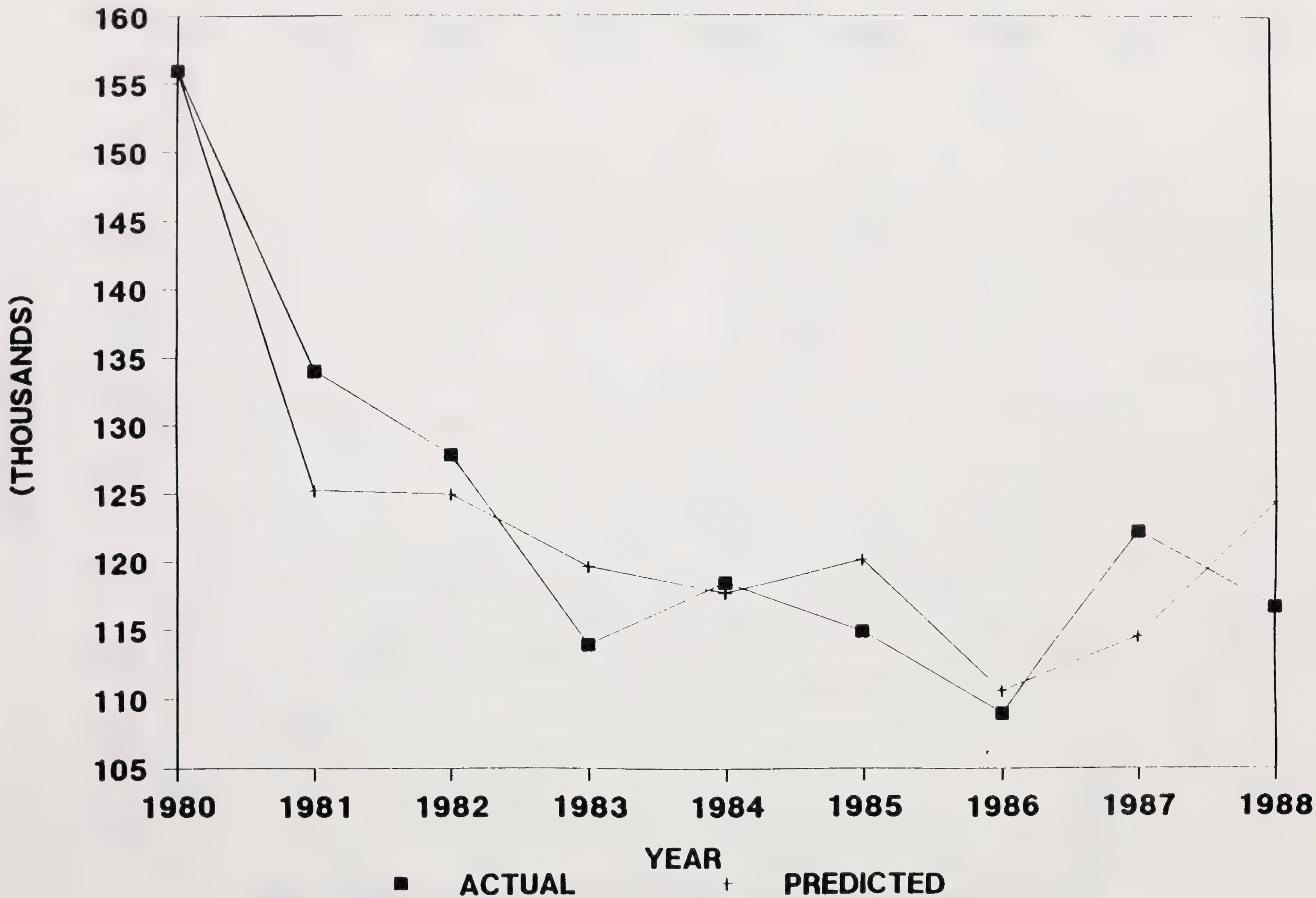
REGION II FEEDER INVENTORY MODEL



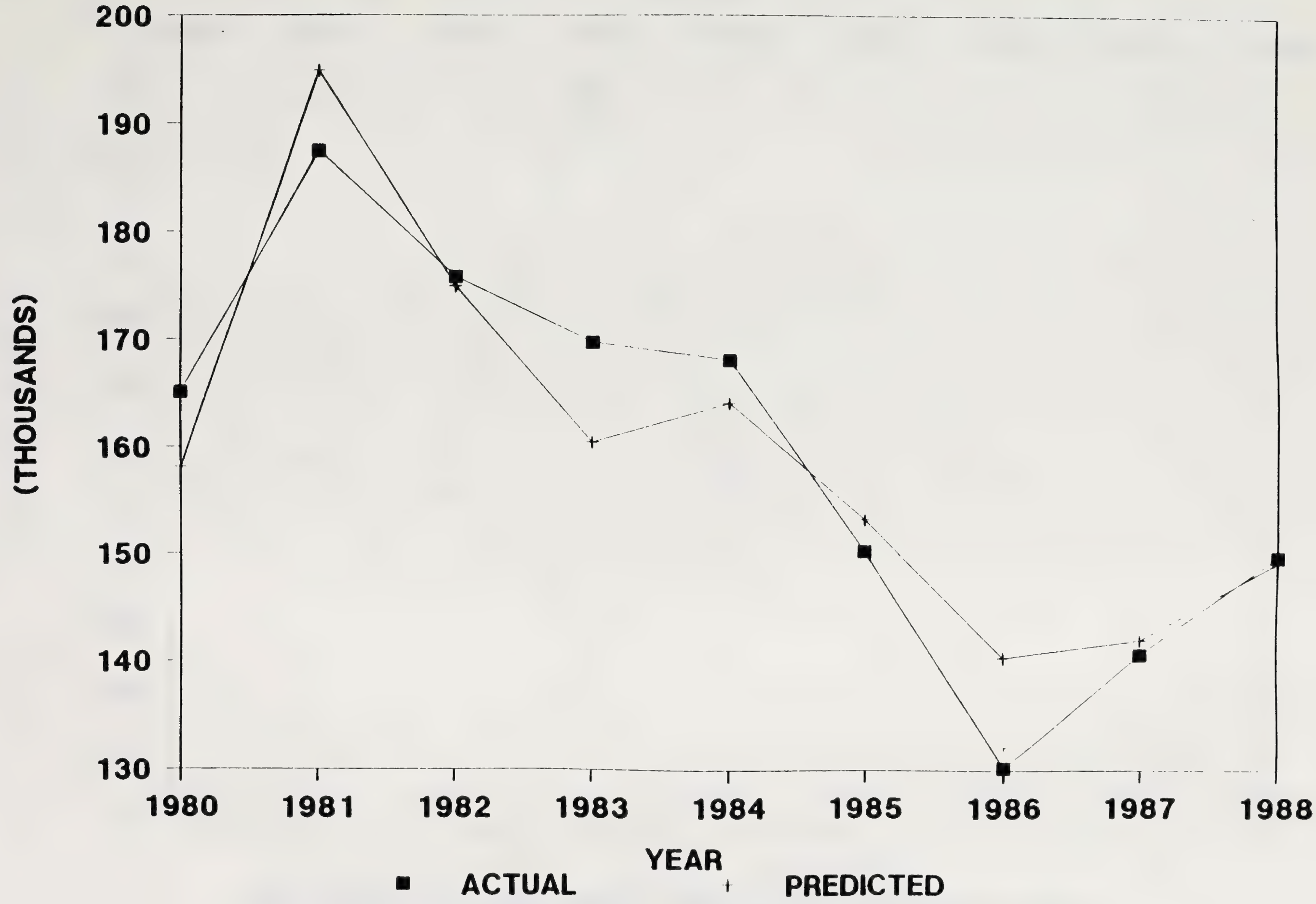
REGION III FEEDER CATTLE INVENTORY



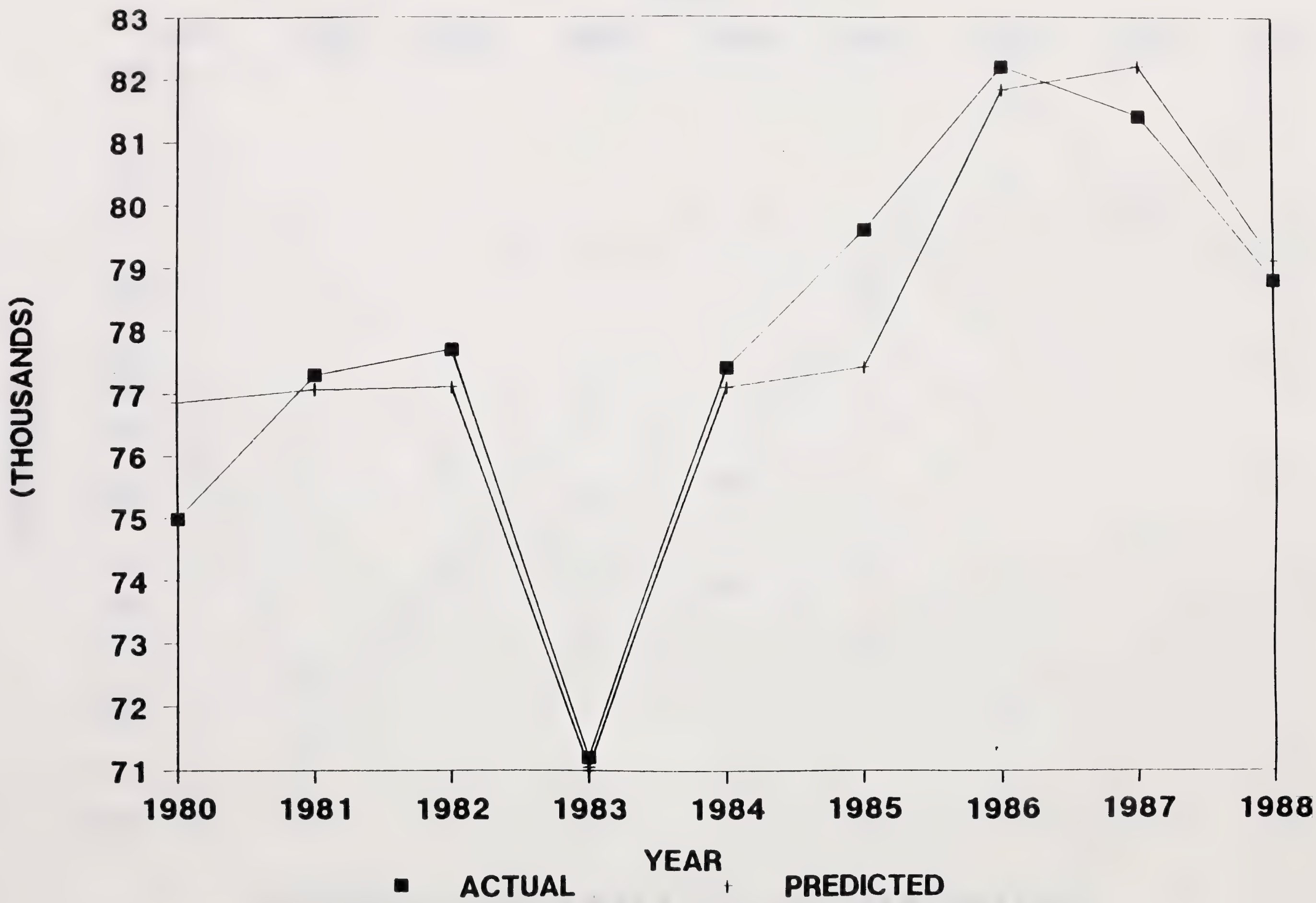
REGION IV FEEDER CATTLE INVENTORY



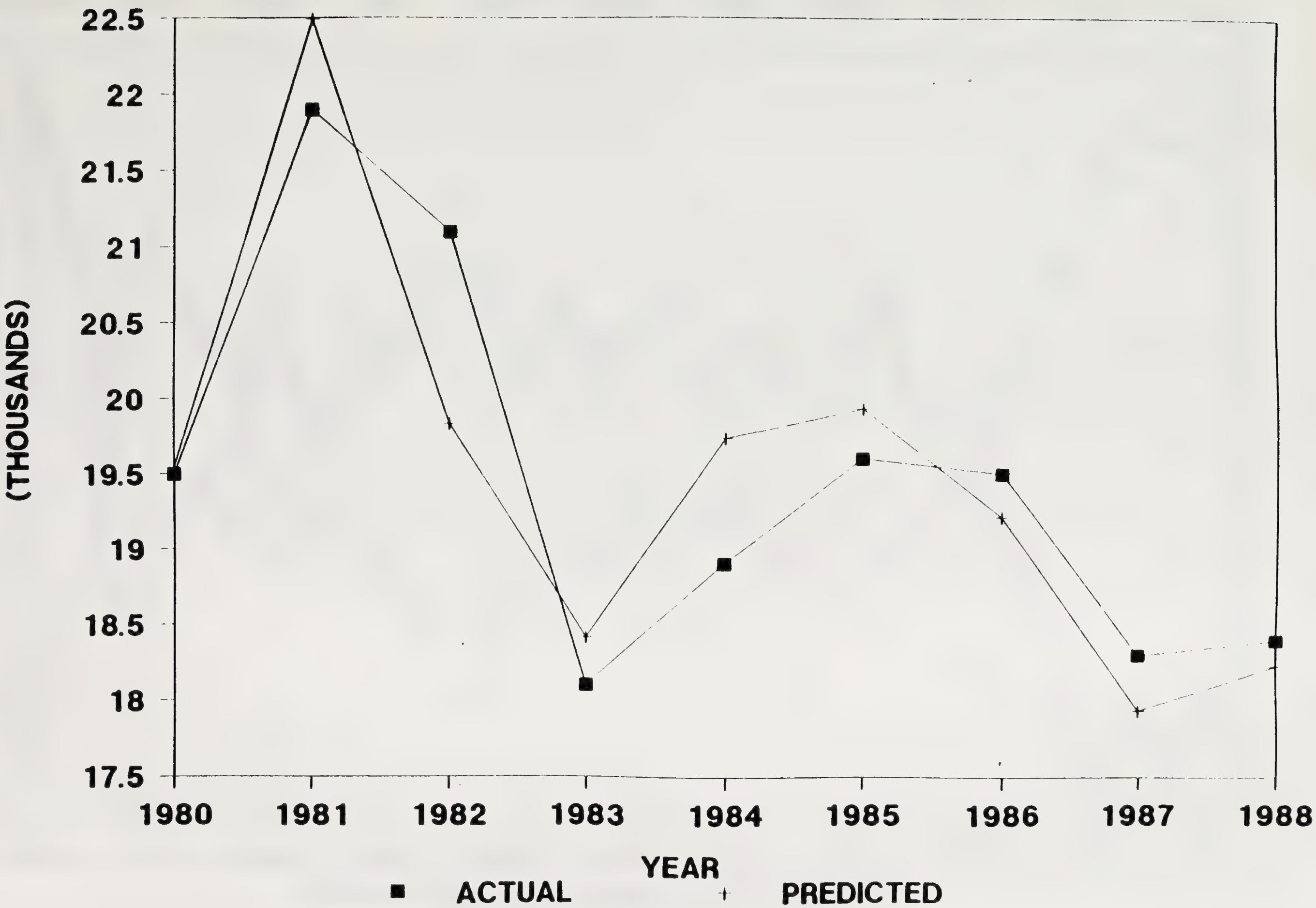
REGION V FEEDER CATTLE INVENTORY

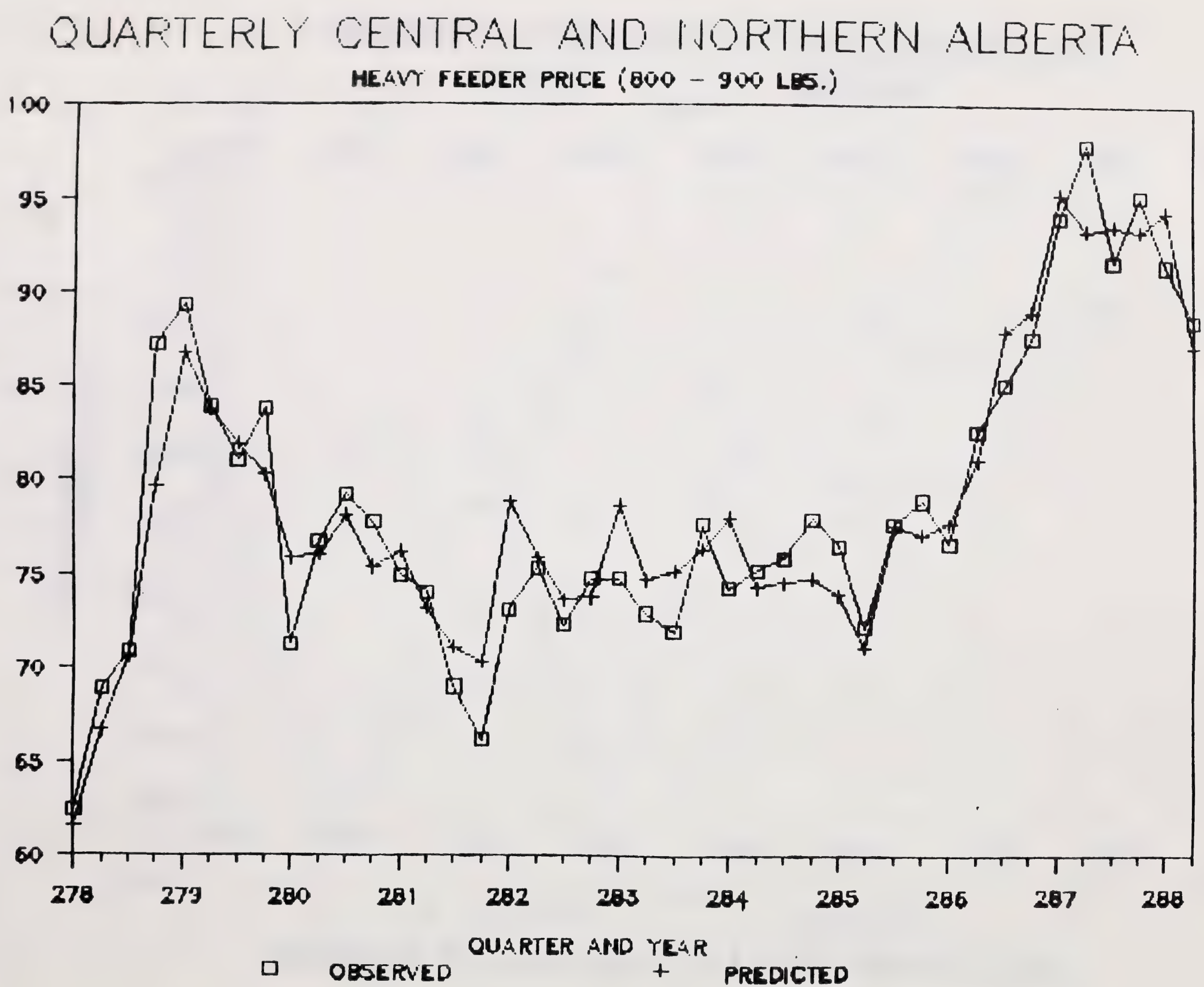


REGION VI FEEDER CATTLE INVENTORY

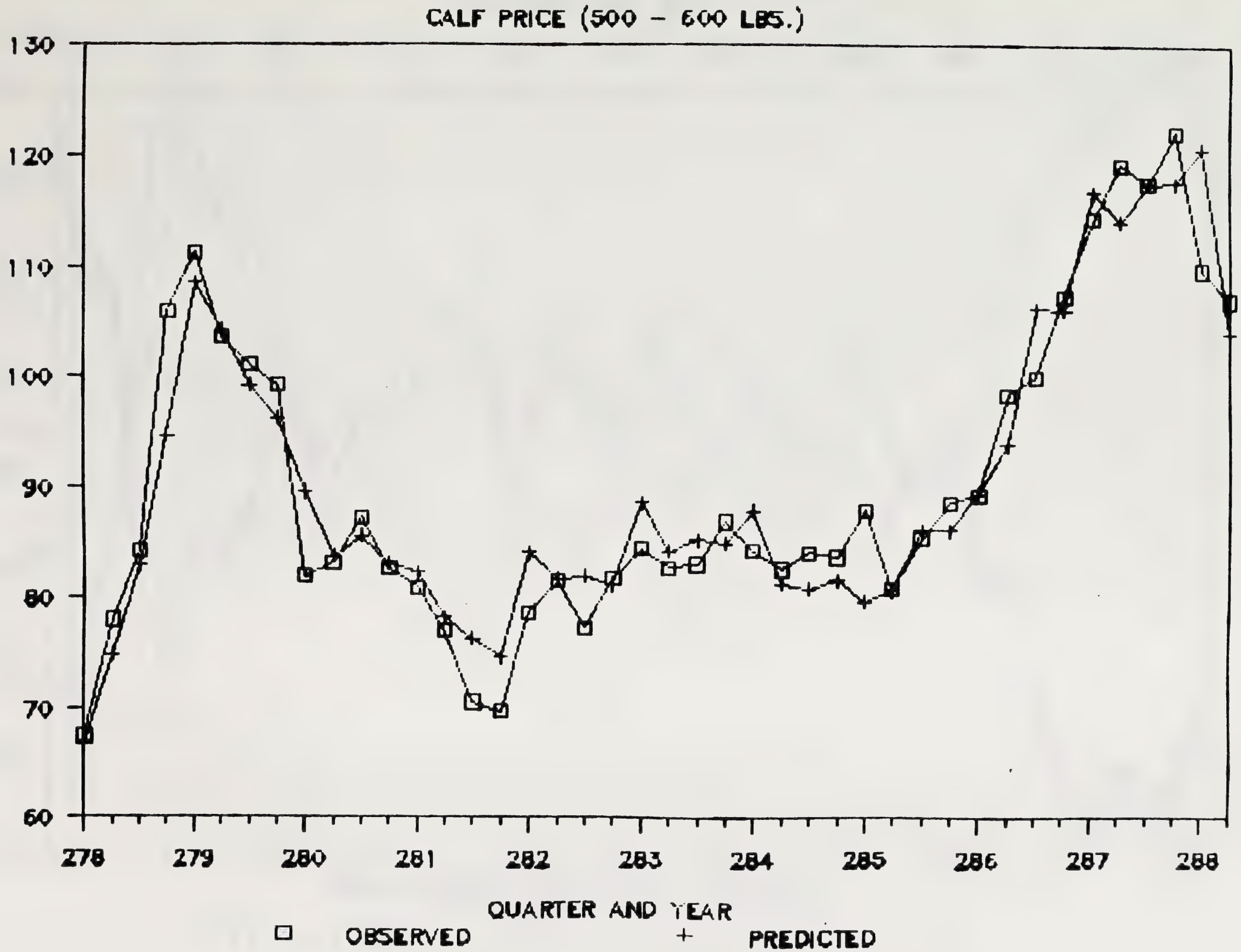


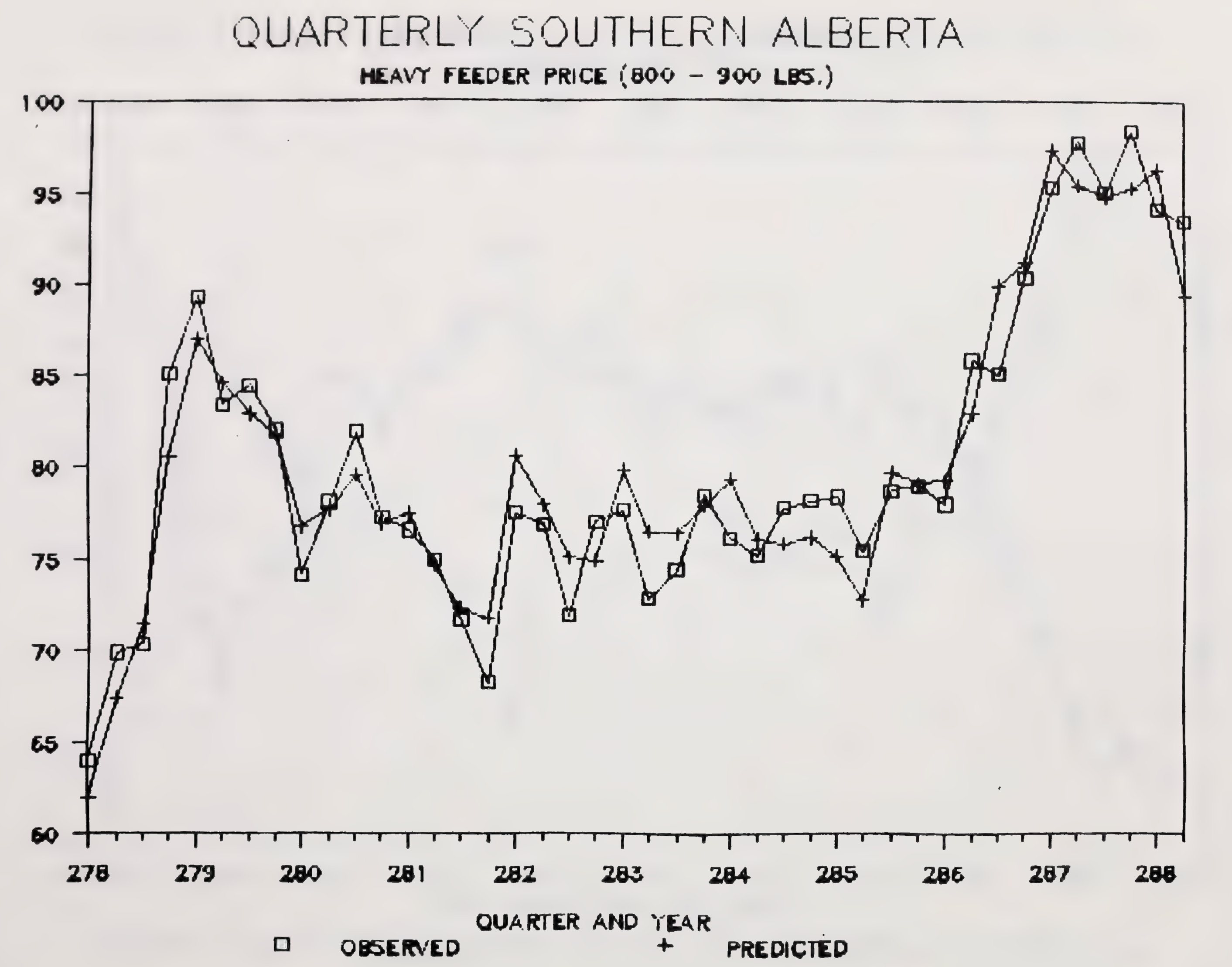
REGION VII FEEDER CATTLE INVENTORY




QUARTERLY CENTRAL AND NORTHERN ALBERTA
HEAVY FEEDER PRICE (800 - 900 LBS.)
100
95
90
85
80
75
70
65
60
278
279
280
281
282
283
284
285
286
287
288
QUARTER AND YEAR
OBSERVED
PREDICTED

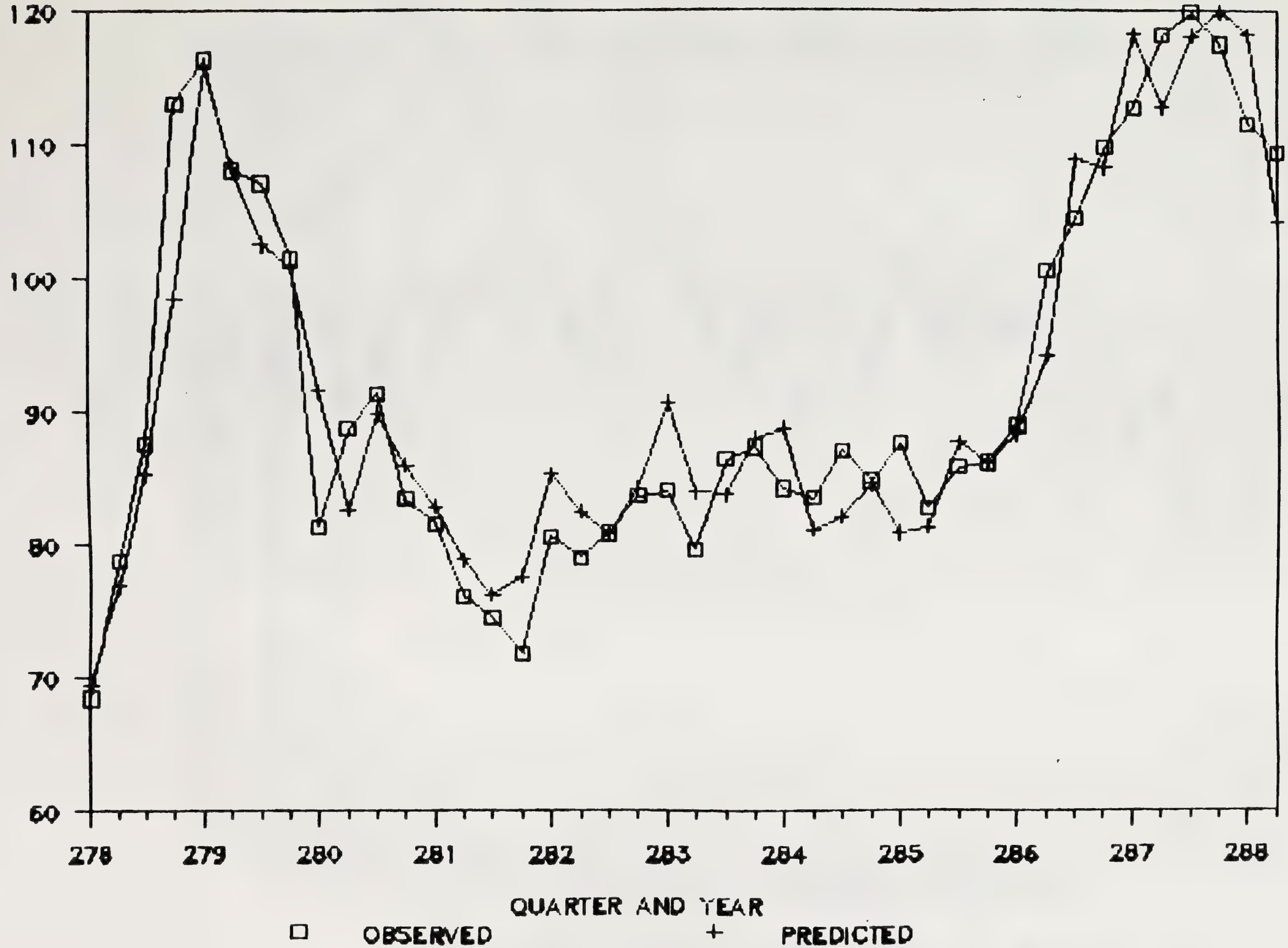
QUARTERLY CENTRAL AND NORTHERN ALBERTA




QUARTERLY SOUTHERN ALBERTA
HEAVY FEEDER PRICE (800 - 900 LBS.)
100
95
90
85
80
75
70
65
60
278
279
280
281
282
283
284
285
286
287
288
QUARTER AND YEAR
OBSERVED
PREDICTED

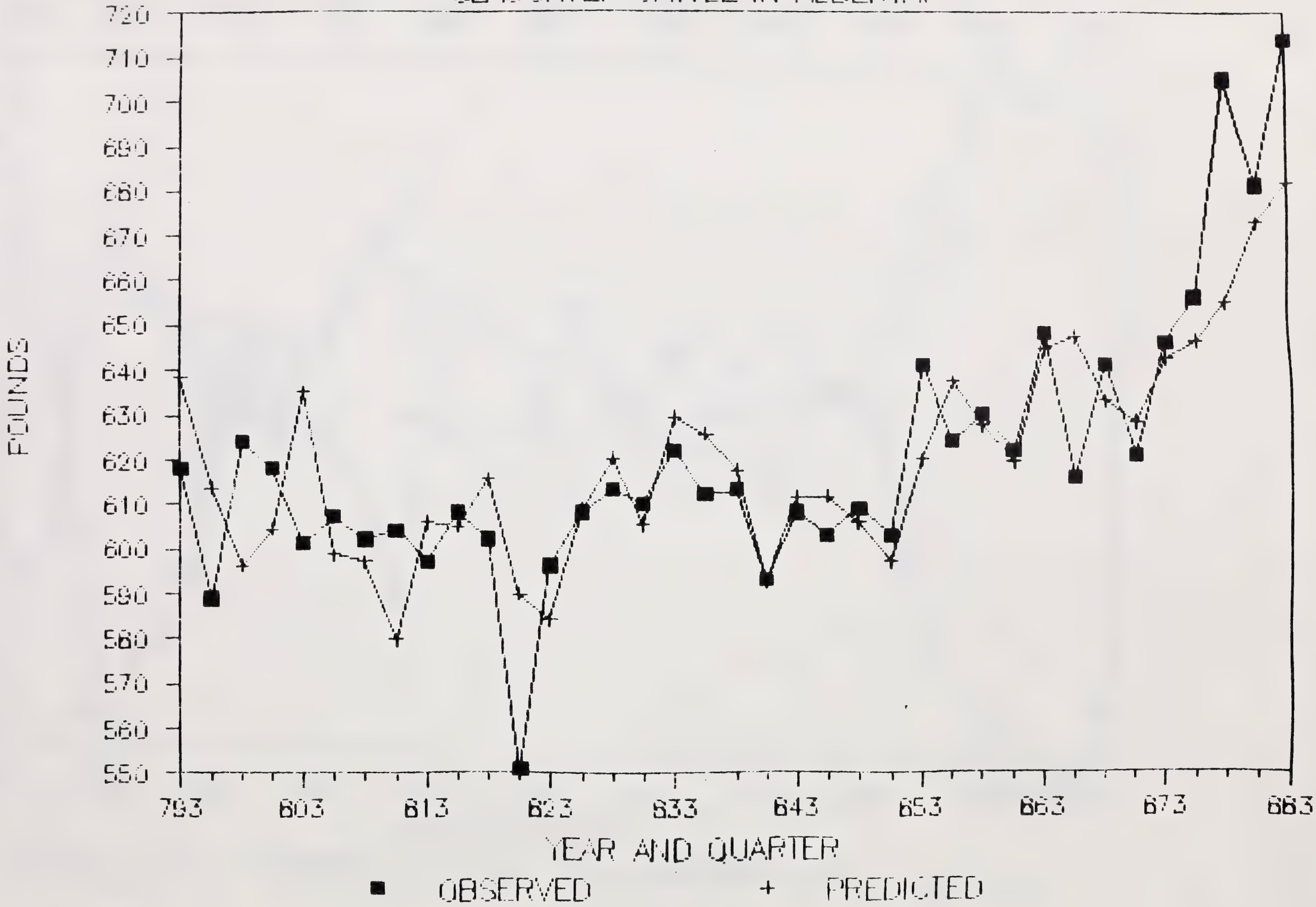
QUARTERLY SOUTHERN ALBERTA CALF PRICE

(500 - 600 LBS.)



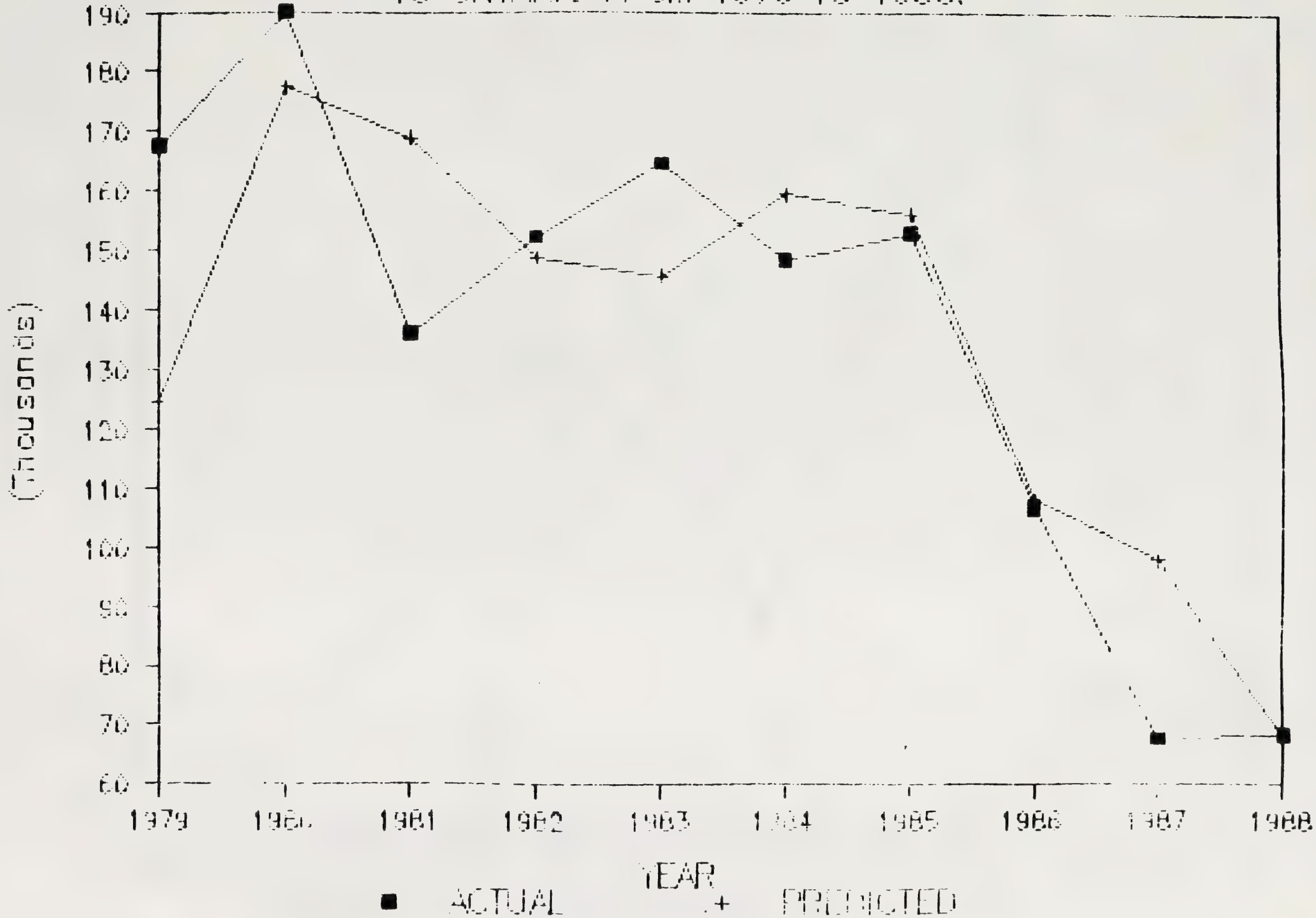
QUARTERLY MEAN WARM CARCASS WEIGHT OF

SLAUGHTER CATTLE IN ALBERTA.



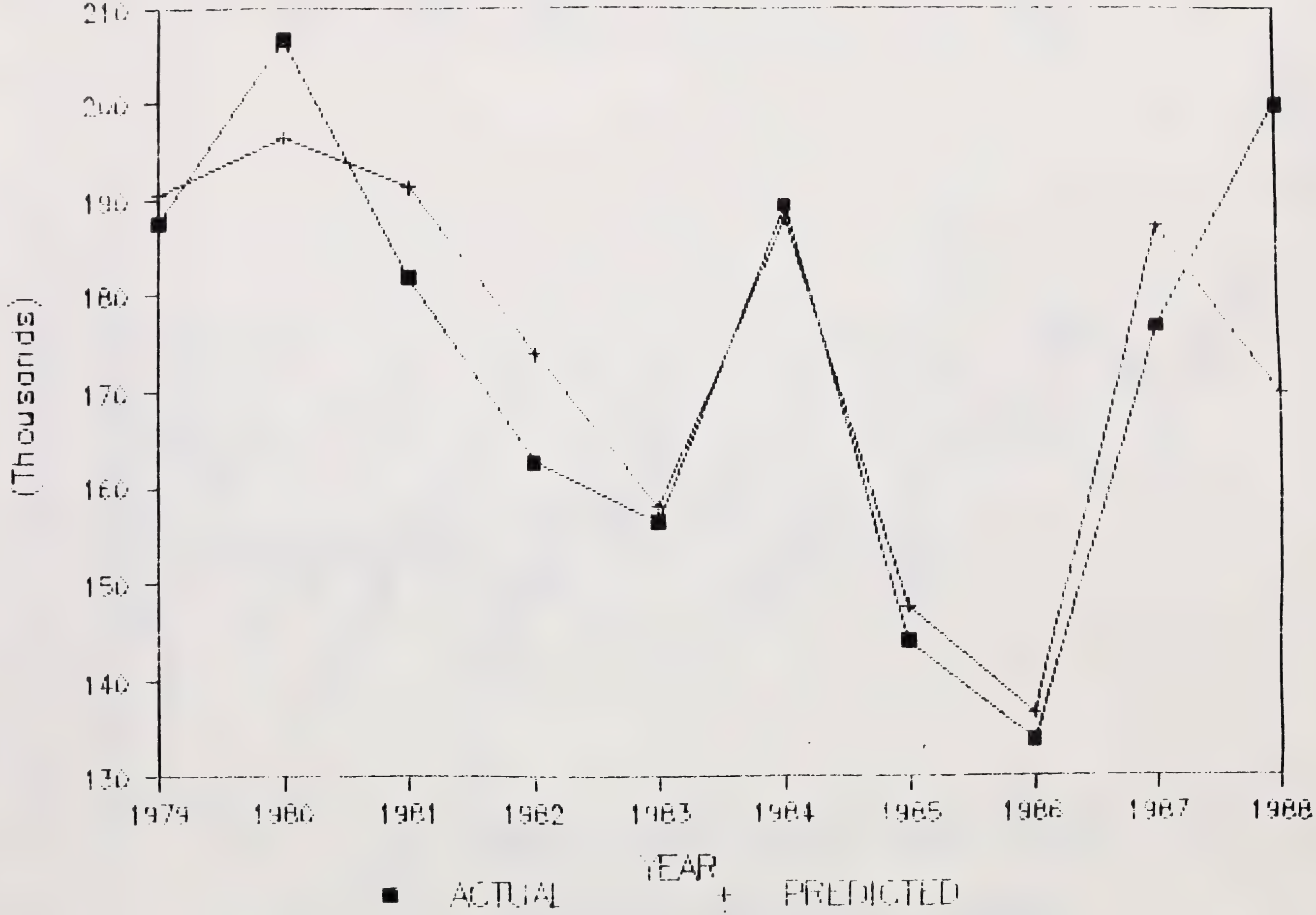
EXPORTS OF FEEDER STEERS AND HEIFERS

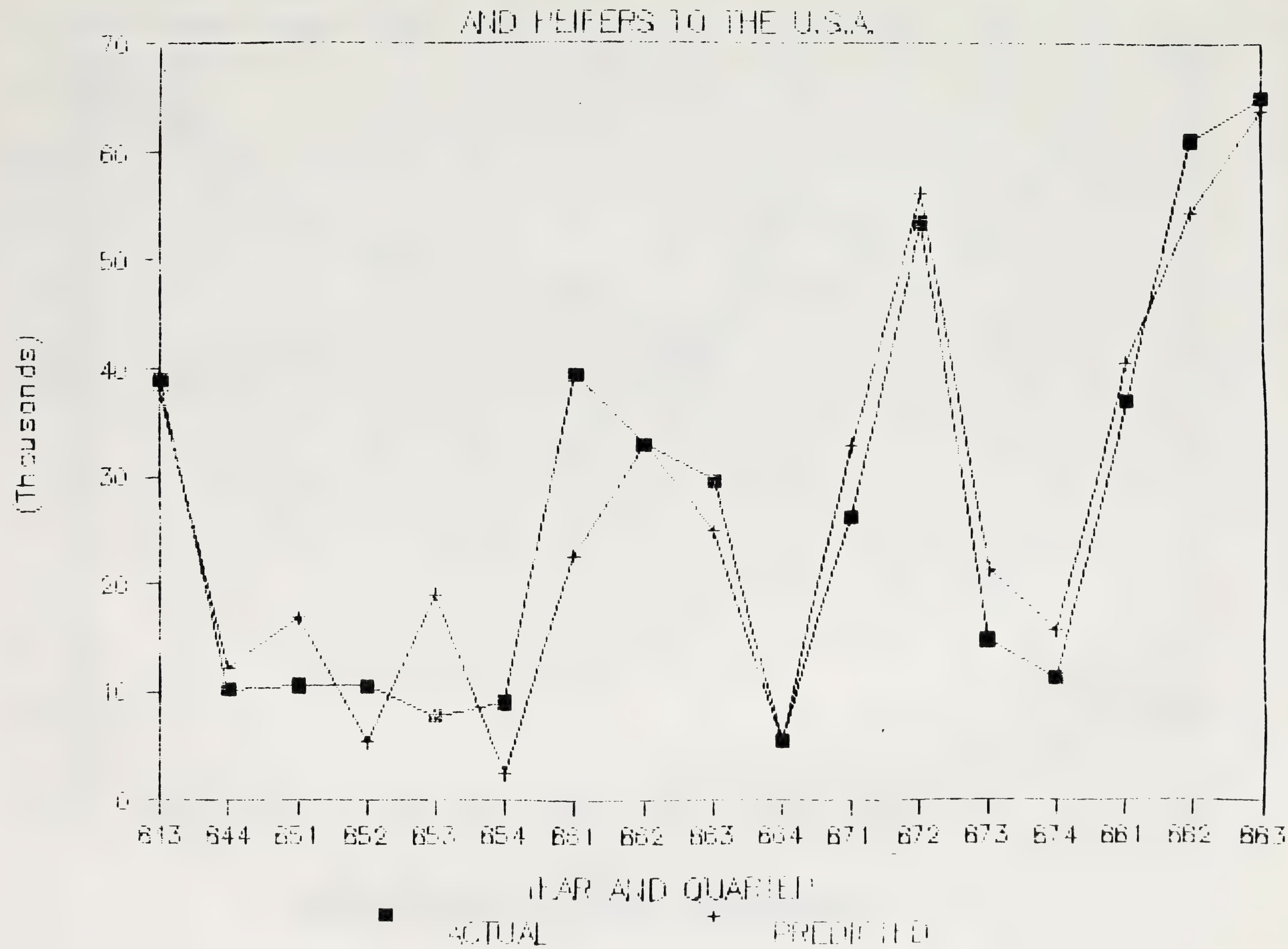
TO ONTARIO FROM 1979 TO 1988.



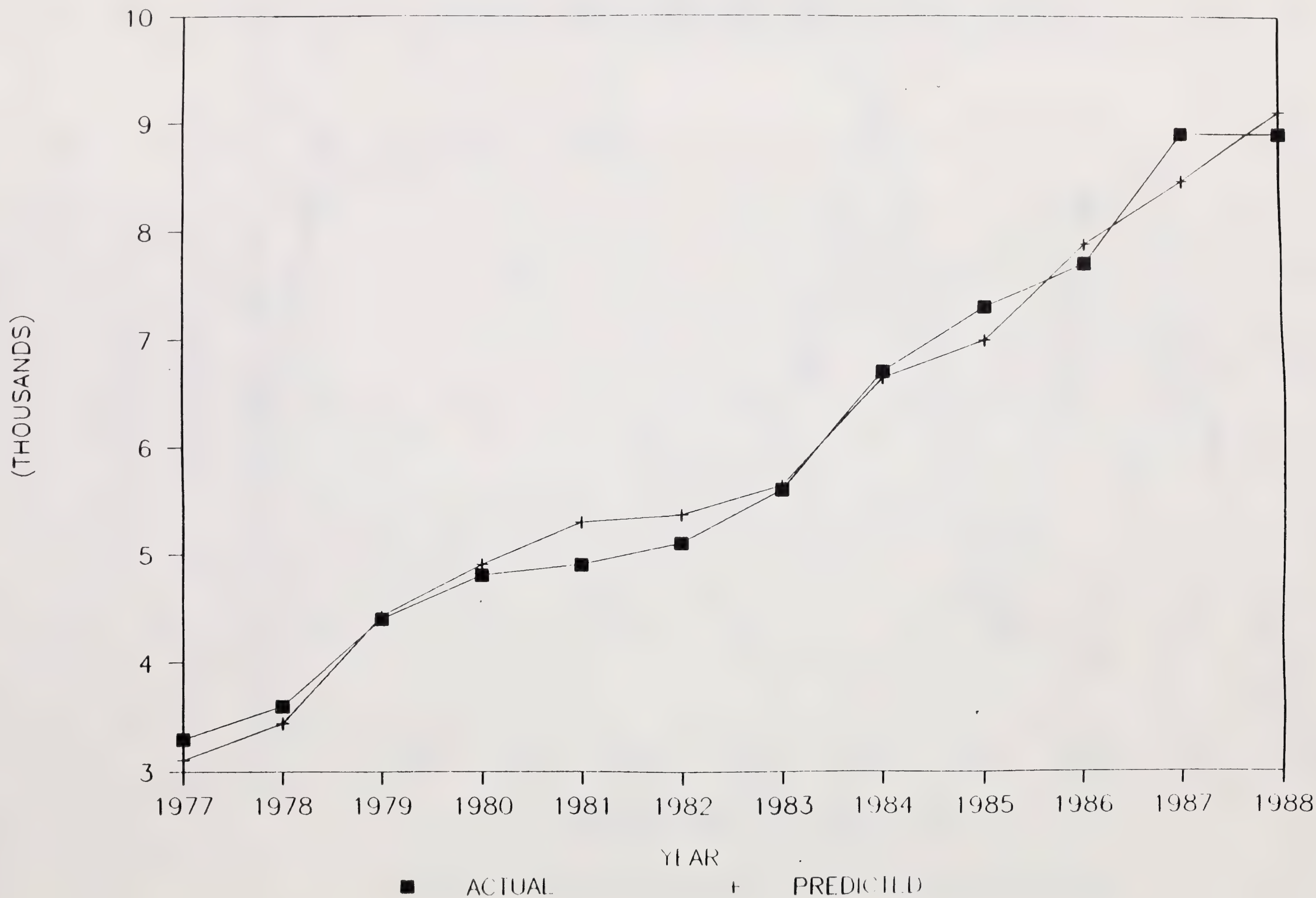
IMPORTS OF FEEDER STEERS AND HEIFERS

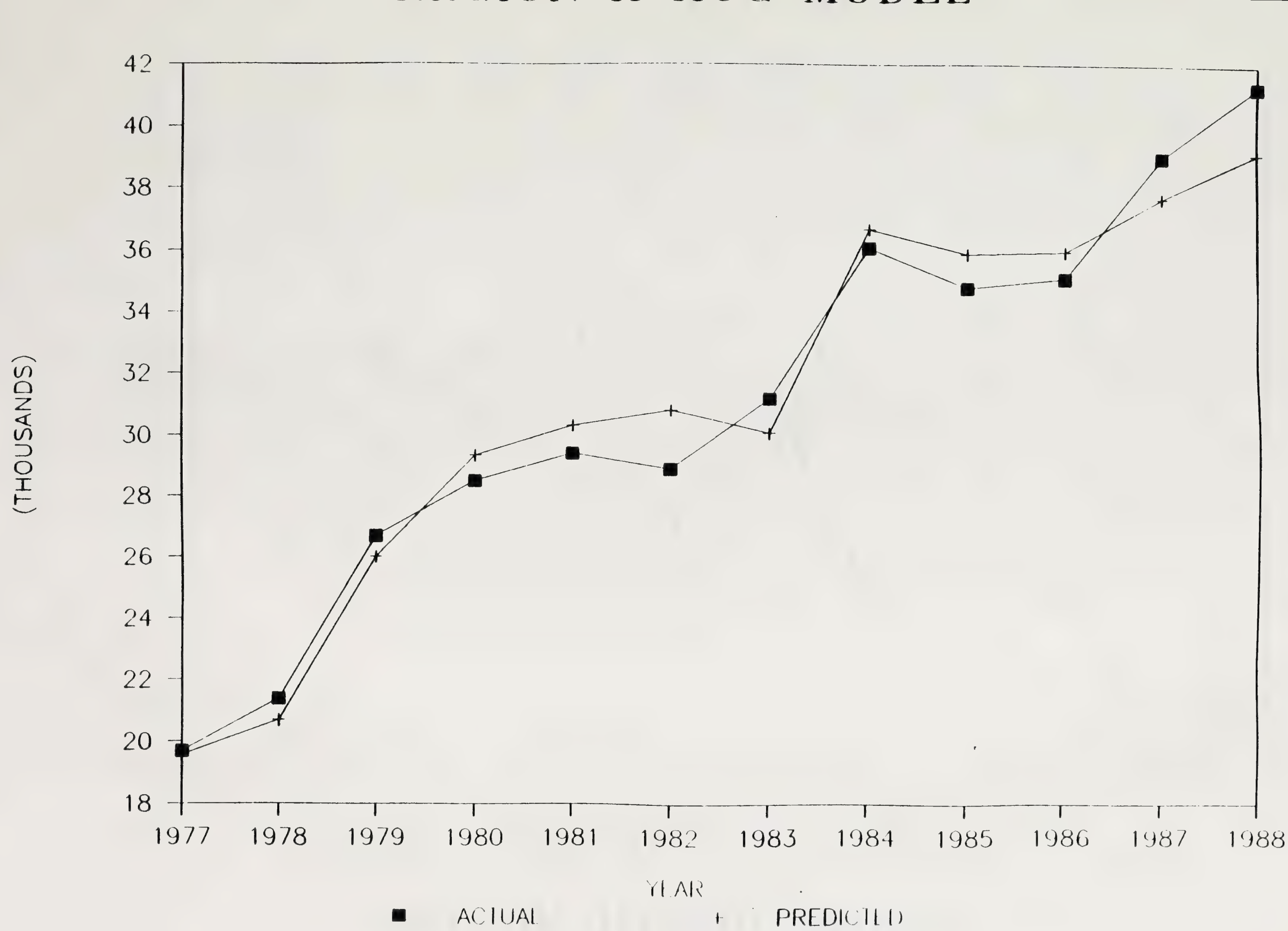
FROM SASKATCHEWAN FROM 1979 TO 1988.




AND HEIFERS TO THE U.S.A.
(Thousands)
70
60
50
40
30
20
10
0
613
644
651
652
653
654
661
662
663
664
671
672
673
674
661
662
663
ACTUAL
PREDICTED

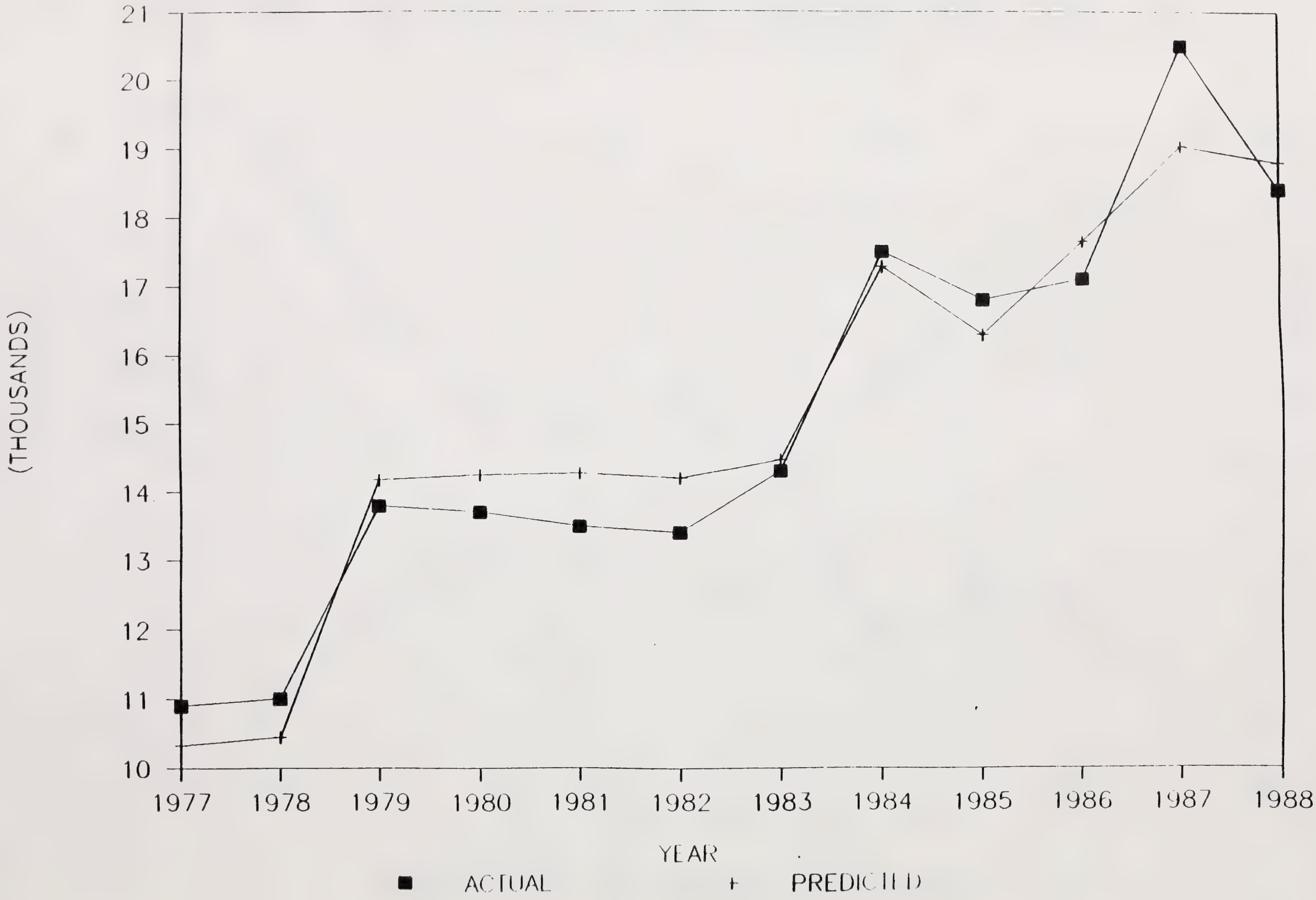
REGION I HOG MODEL



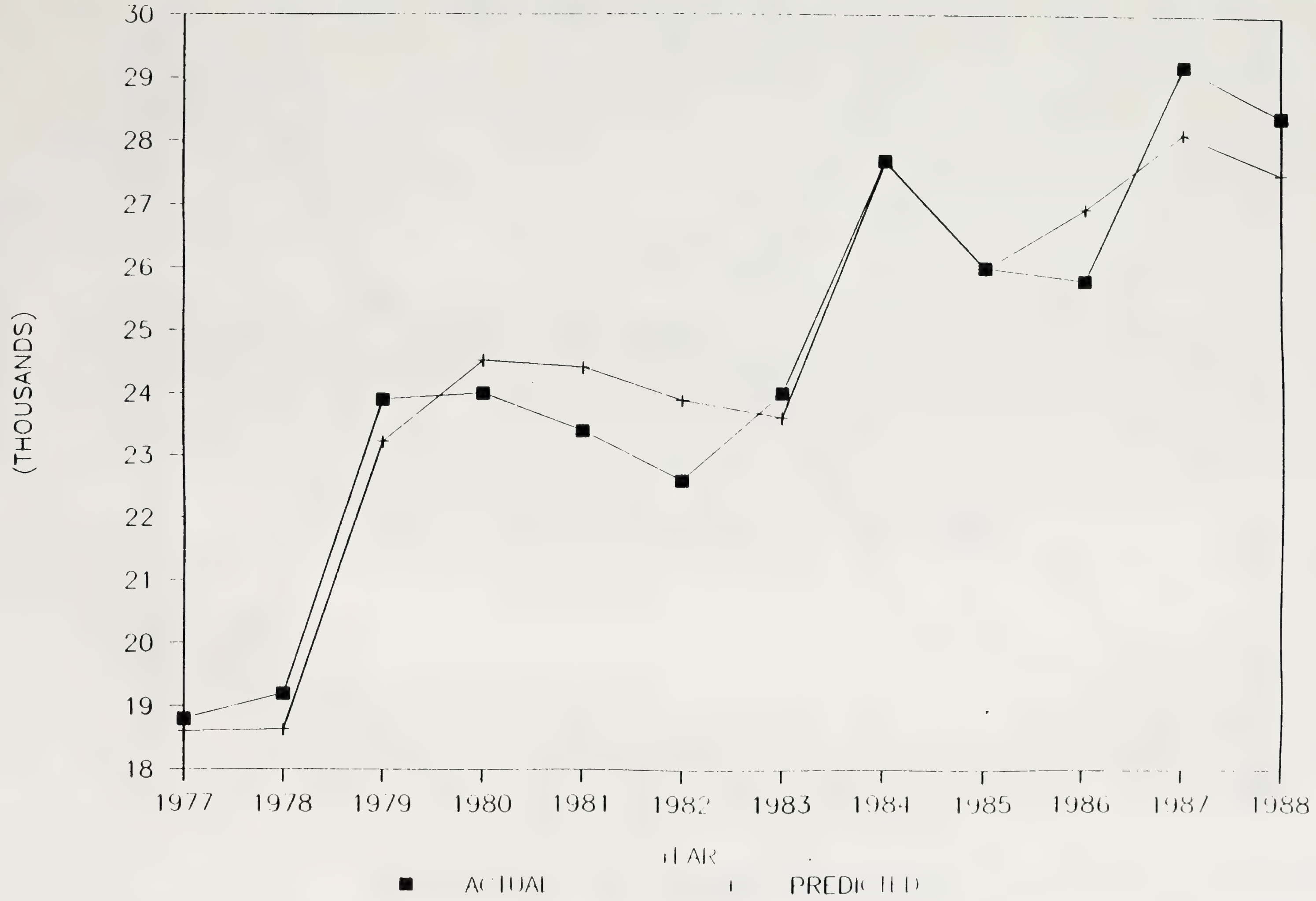


MODEL
(THOUSANDS)
42
40
38
36
34
32
30
28
26
24
22
20
18
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR
ACTUAL
PREDICTED

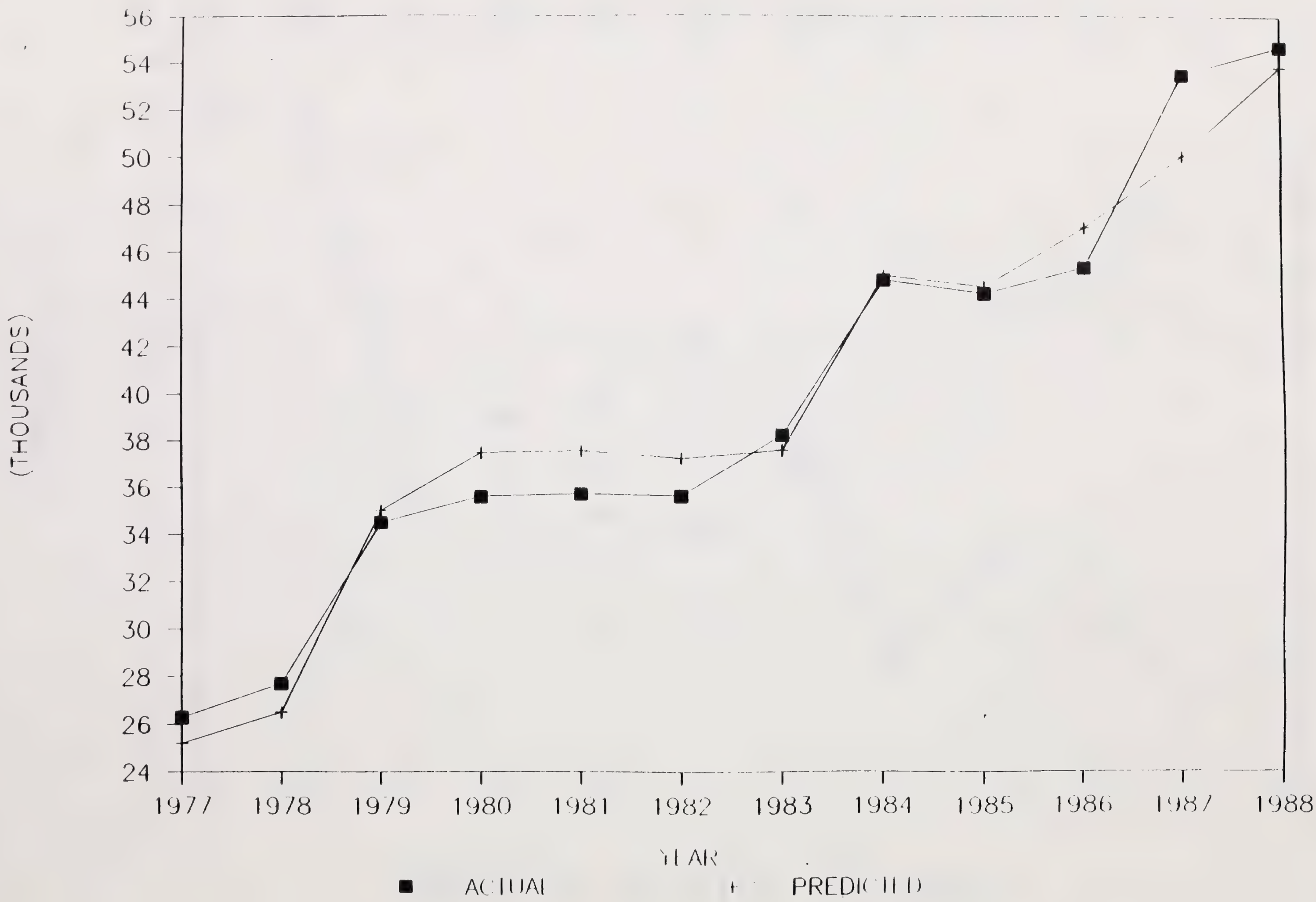
REGION III HOG MODEL

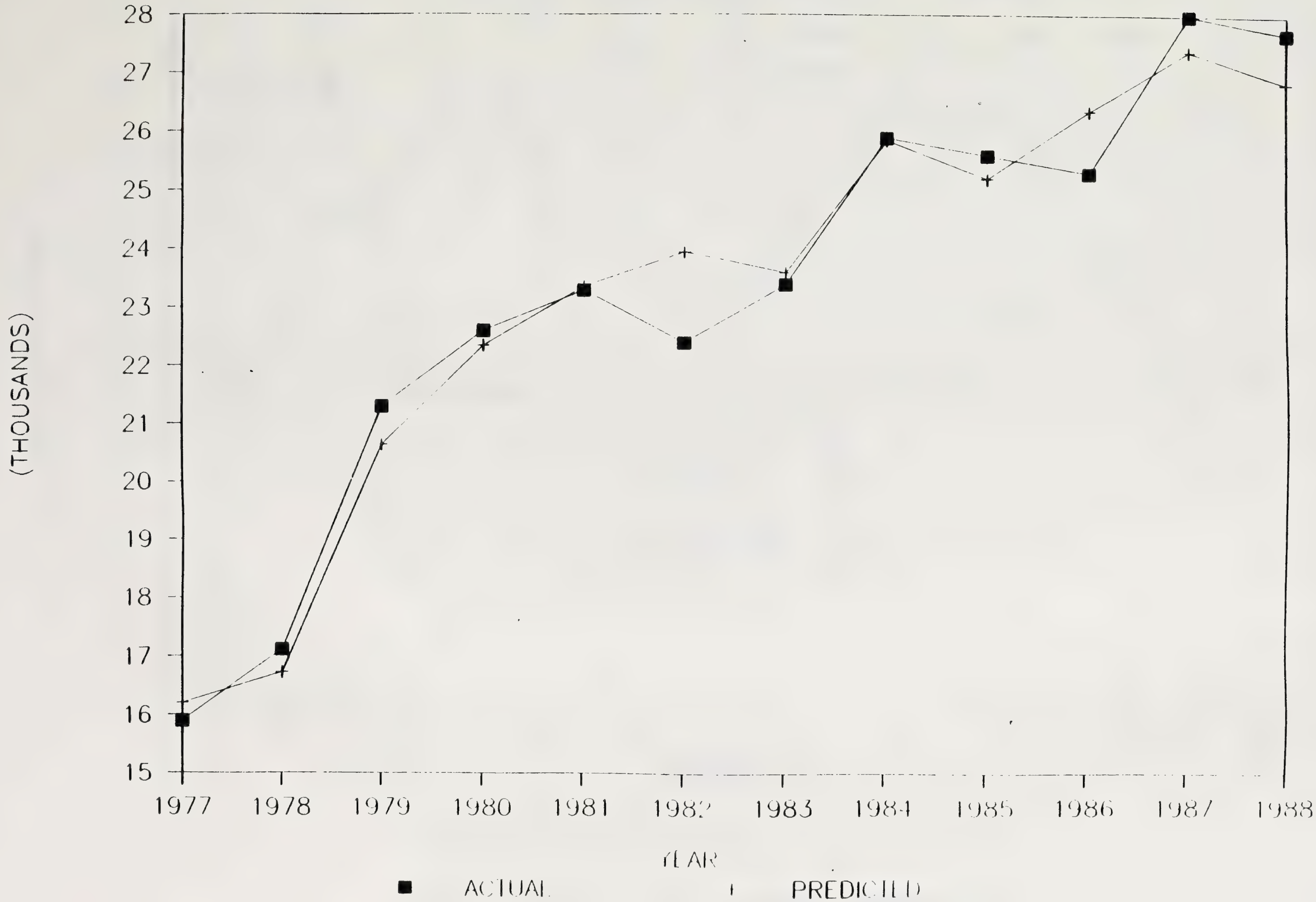


REGION IV HOG MODEL

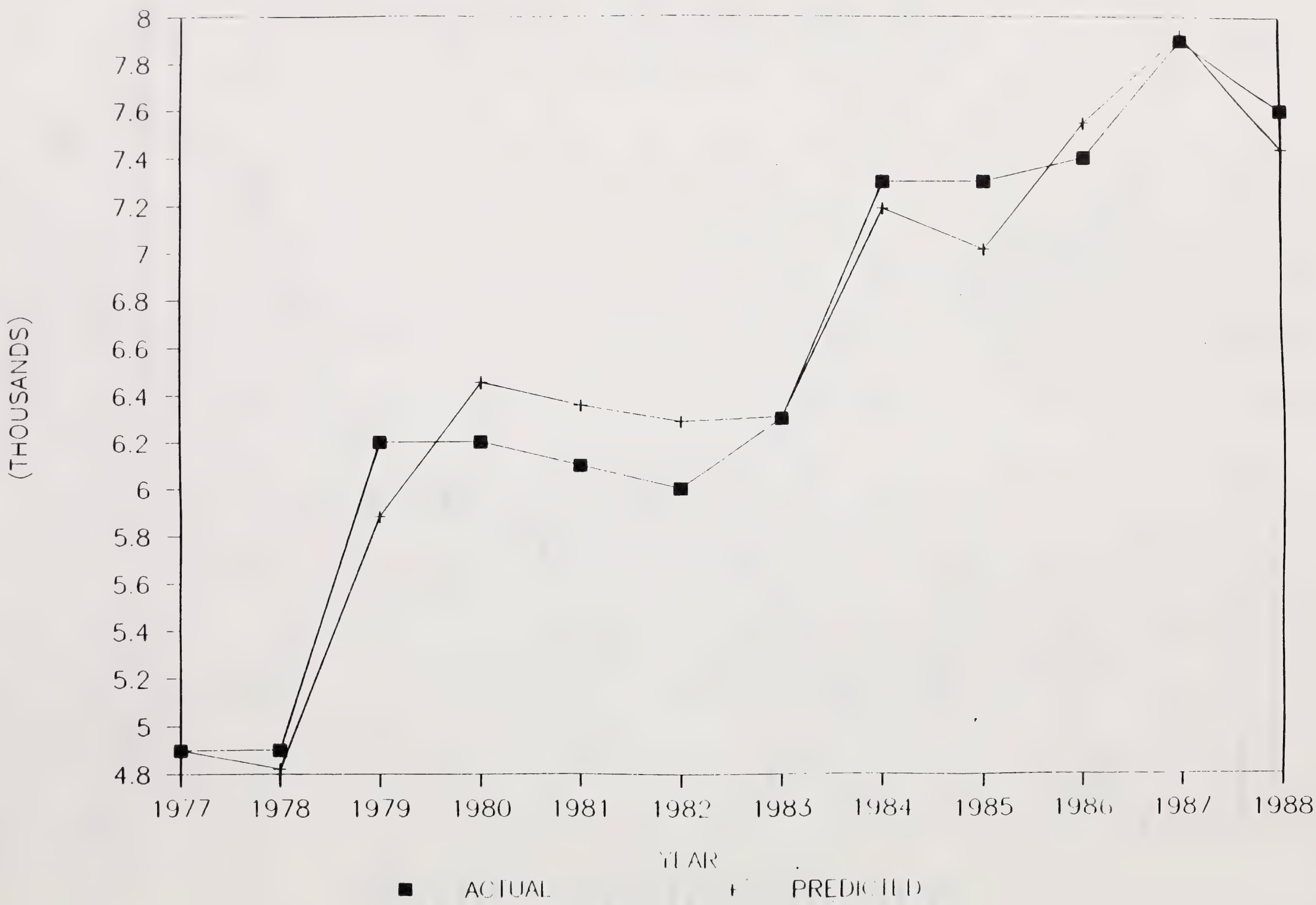


REGION V HOG MODEL

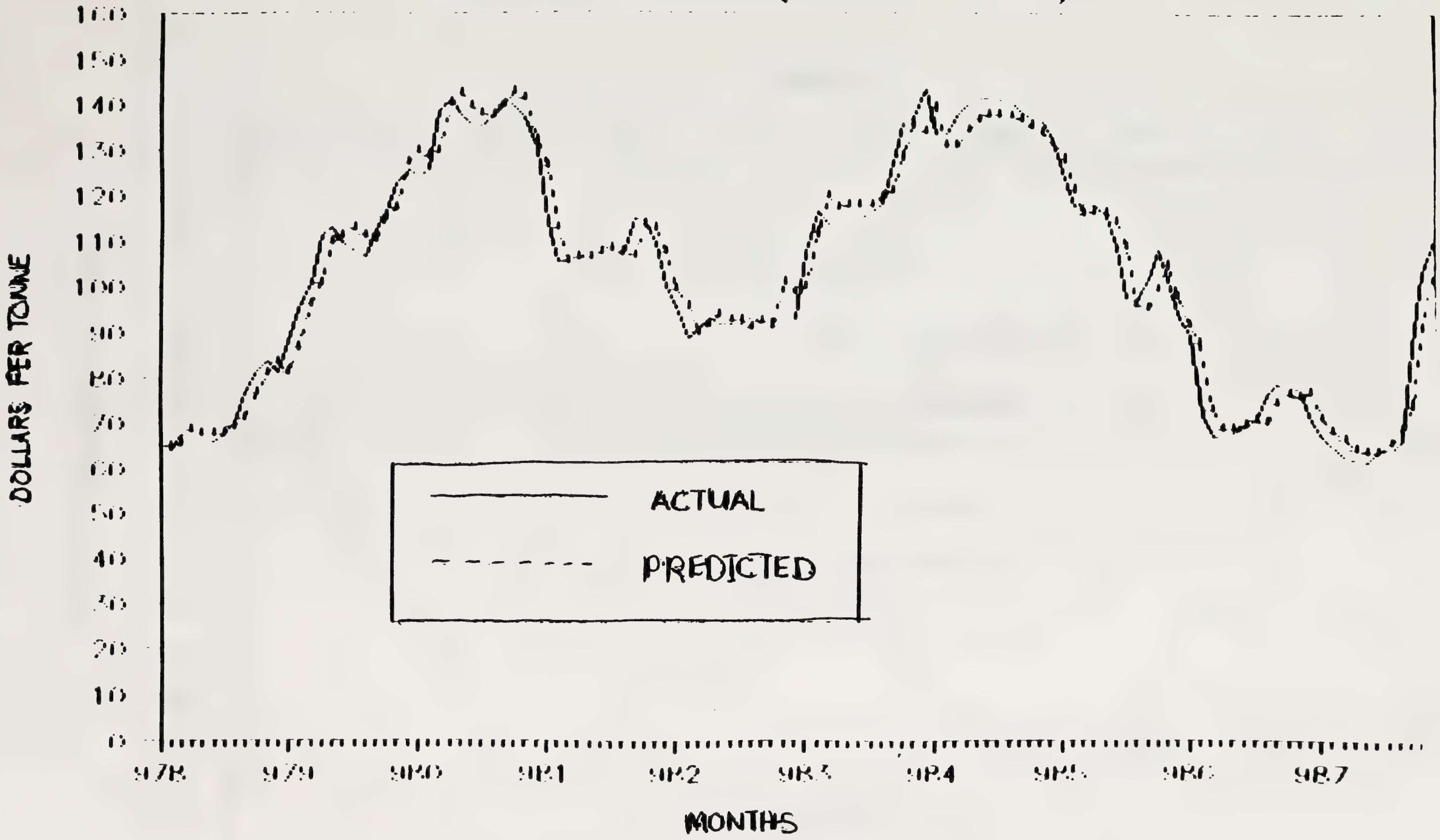



28
27
26
25
24
23
22
21
20
19
18
17
16
15
(THOUSANDS)
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR
ACTUAL
PREDICTED

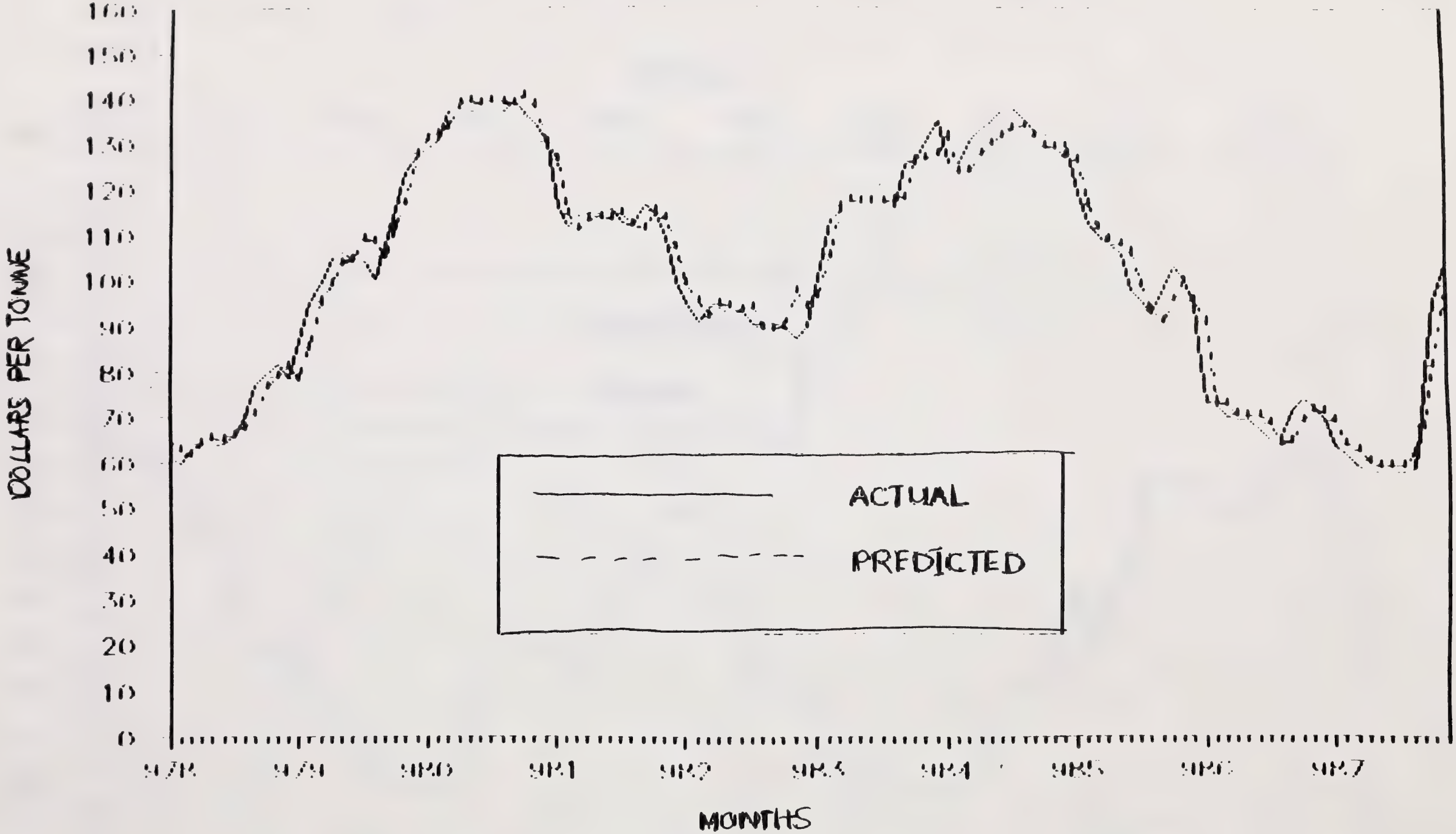
REGION VII HOG MODEL



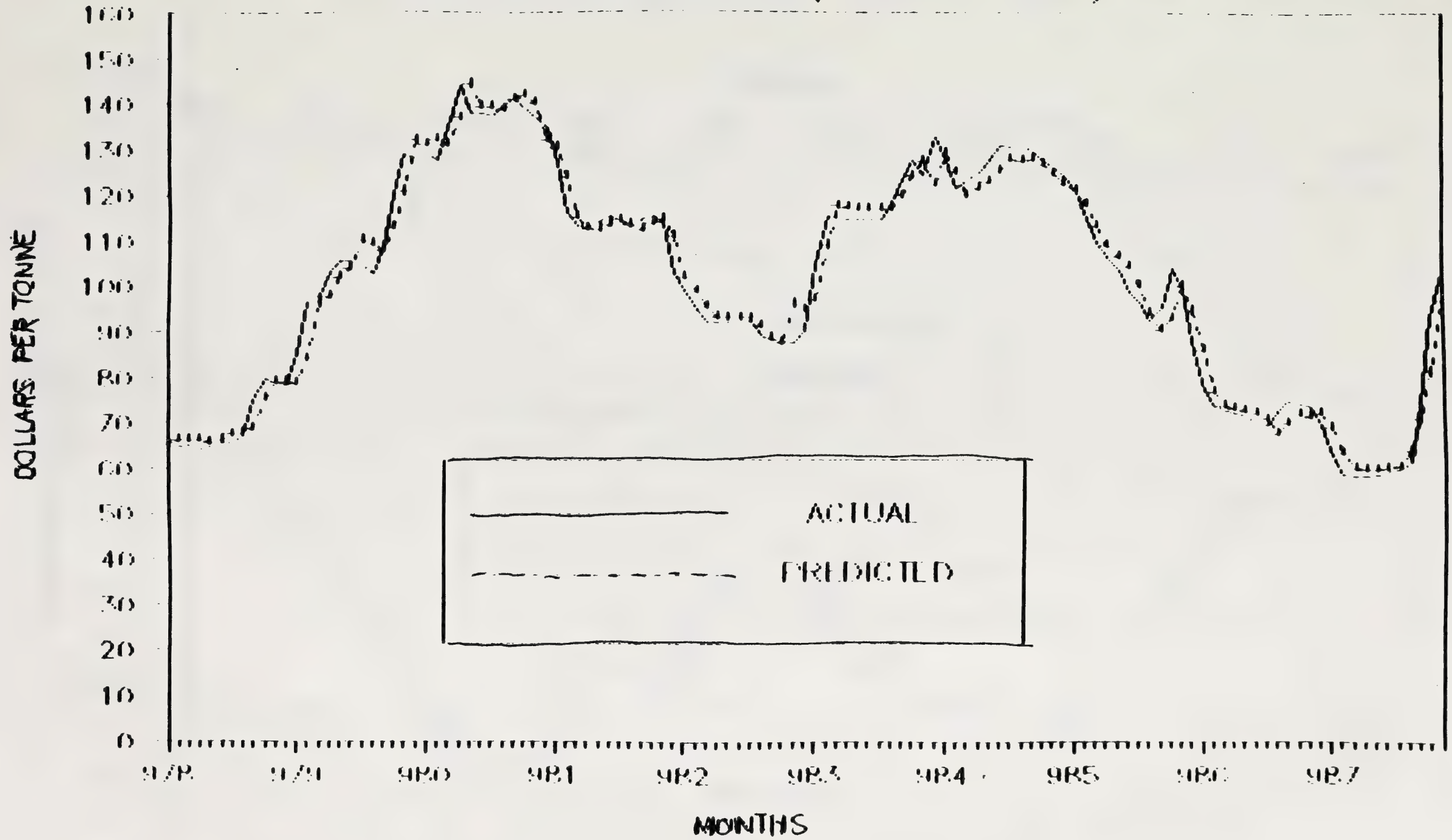
CALGARY REGION (1978 – 1988)



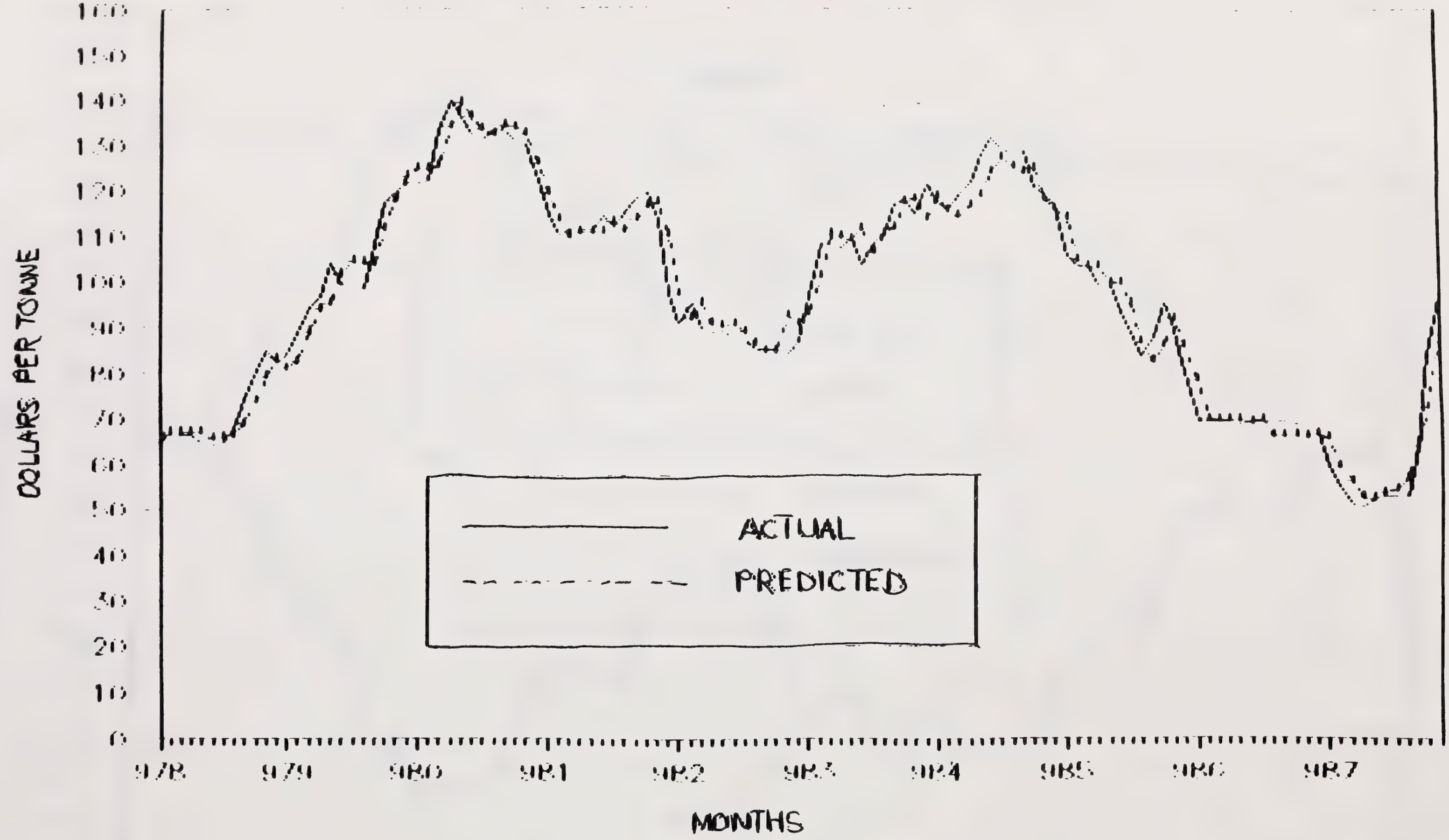
ACTUAL AND PREDICTED AGC PRICES
RED DEER REGION (1978 – 1988)

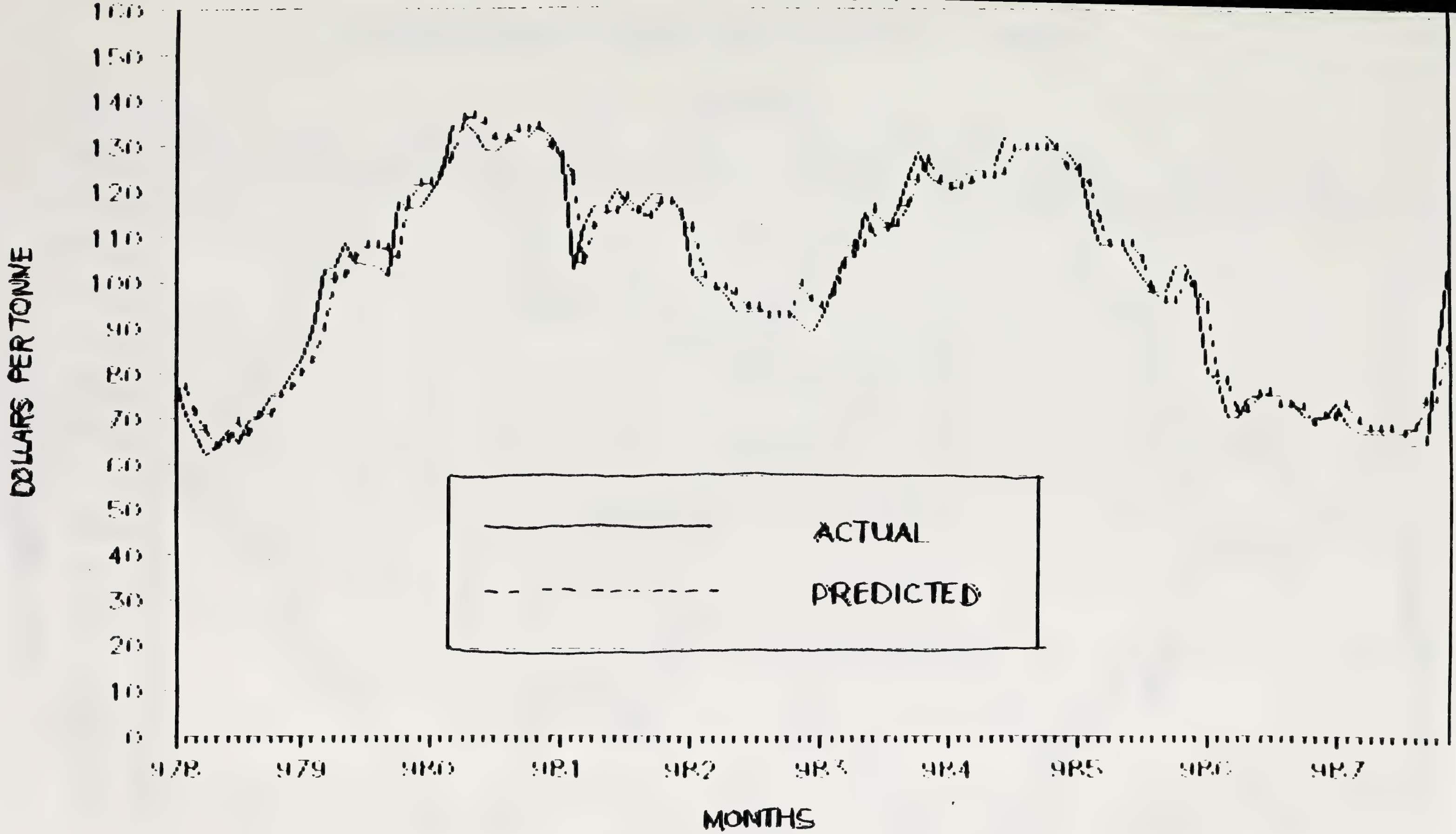


EDMONTON REGION (1978 – 1988)



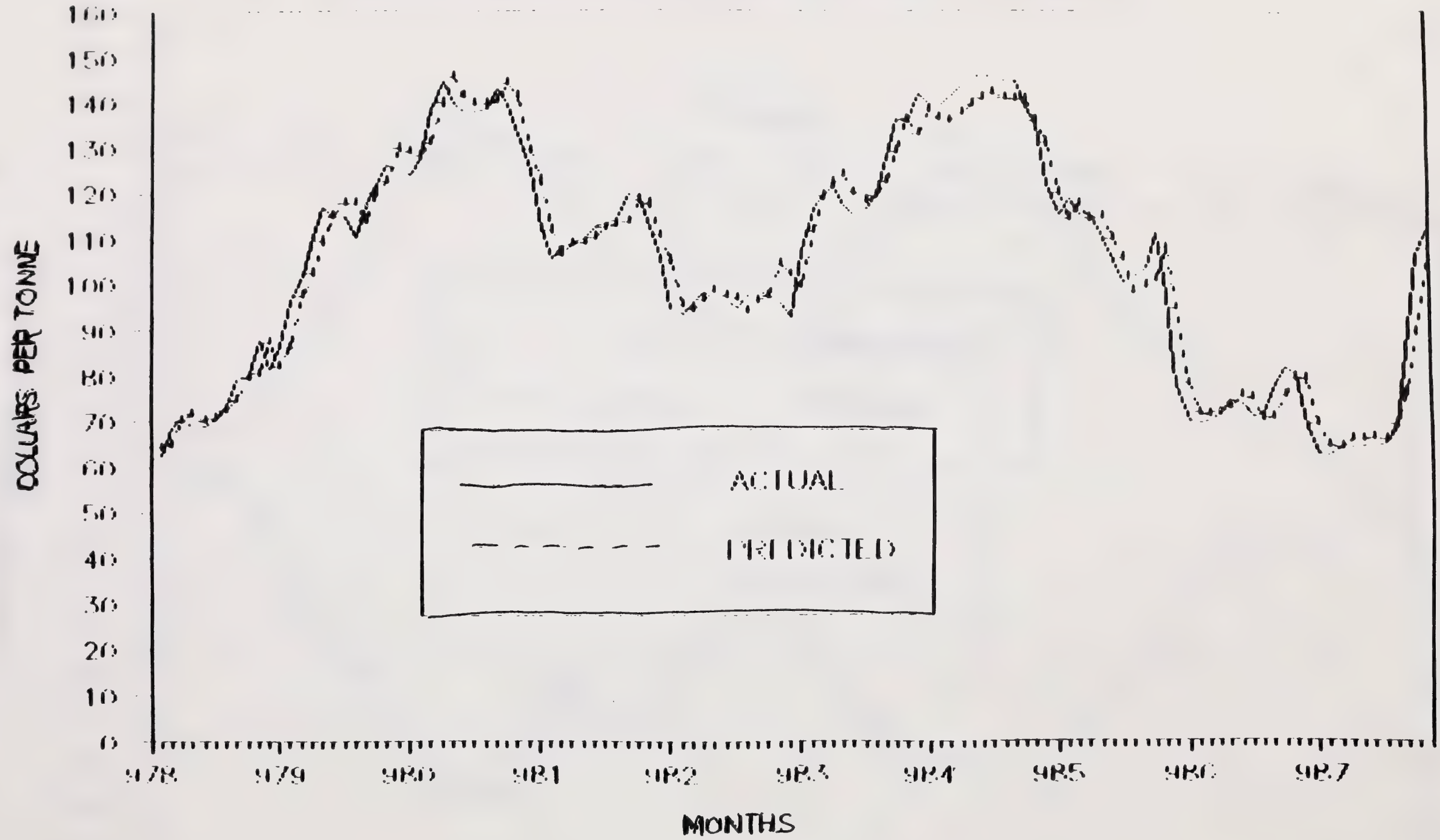
ACTUAL AND PREDICTED AGC PRICES
VERMILION REGION (1978 – 1988)



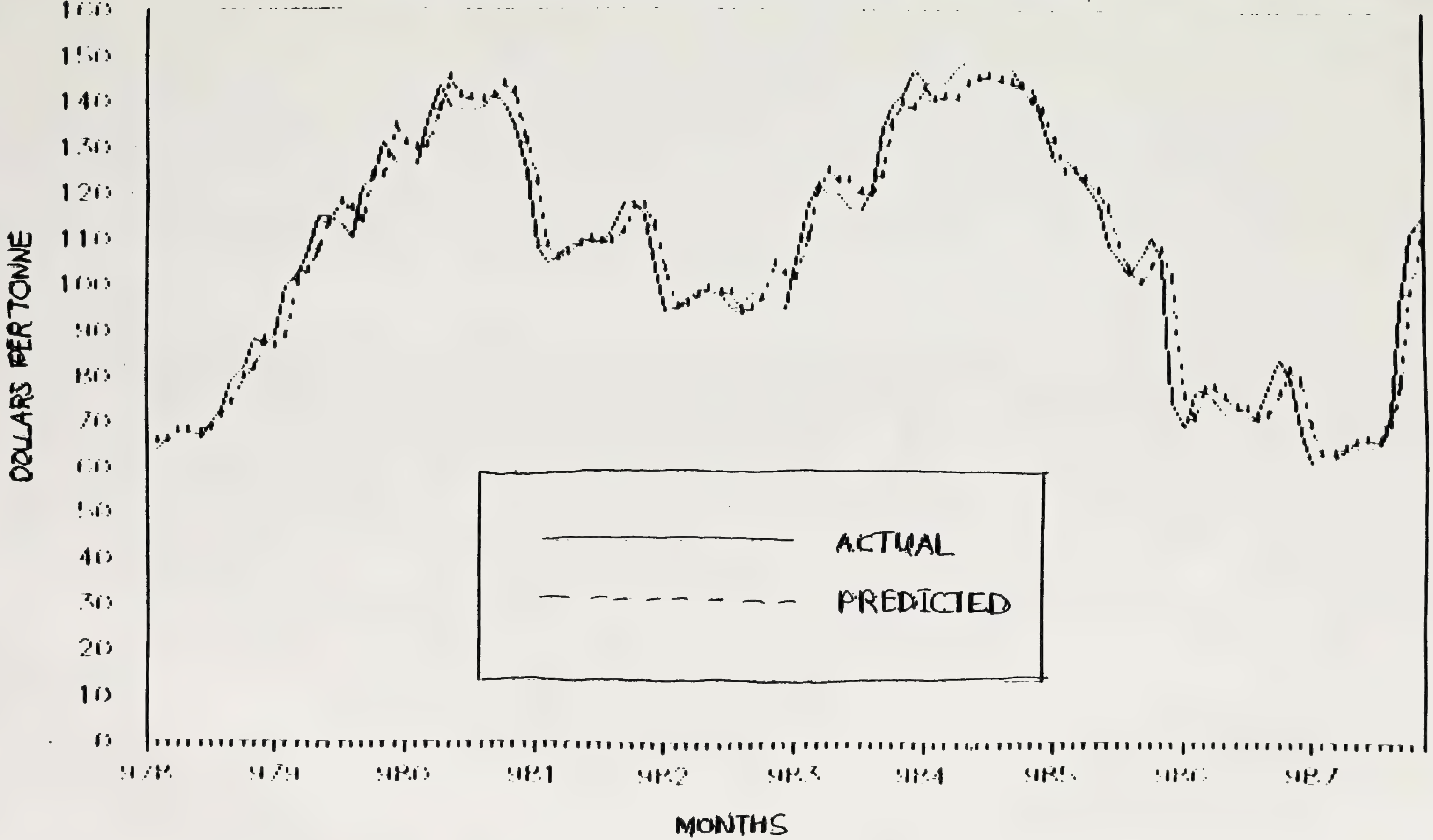


DOLLARS PER TONNE
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
MONTHS
ACTUAL
PREDICTED

ACTUAL AND PREDICTED AGC PRICES
MEDICINE HAT REGION (1978 – 1988)



LETHBRIDGE REGION (1978 - 1988)



APPENDIX D

APPENDIX D

SENSITIVITY ANALYSIS

A sensitivity analysis on yield and on a number of coefficients in the model was undertaken to depict a possible range in magnitude of the results. Three scenarios, in which no more than one coefficient was changed at a time, were completed. Each of the scenarios, with the exception of yield, were run with a 5% decline in the coefficient and then a 5% increase. The scenarios are as follows:

1. 5% decline/increase in both the GTRAN coefficient in the grain supply equations and in the off-Board barley price (or other shifter such as lagged inventories) coefficient in the livestock equations.

2. 5% decline/increase in both the Board/non-Board price coefficient in the grains equations and in the calf/hog price in the livestock equations.

3. 5% decline in yield.

The above sensitivity runs were made on the producer method of payment option in the simulation model.

Results

Scenario 1

The following table depicts the average grain and livestock results under baseline, method of payment, a 5% increase and a 5% decline in the GTRAN and off-Board barley price coefficients.

Table 1: Grain Production and Livestock Inventory Changes under Sensitivity Scenario 1.

BASELINE

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	27838	59171	16931	53452	7531	6887	18670	190480
BARLEY	3743	39366	44987	49415	64217	34774	35776	272278
CANOLA	405	5771	4092	18514	11748	4926	13694	59151
OATS					17012			

HOGS (000 Head)	MEAN	Cows(000 Head)	MEAN	FEEDERS (000 Head)	MEAN
RED DEER	43.7	RED DEER	249	RED DEER	160
VERMILION	25.9	VERMILION	261	VERMILION	124
CALGARY	16.3	CALGARY	226	CALGARY	144
EDMONTON	24.9	EDMONTON	218	EDMONTON	78
LETHBRIDGE	34.1	LETHBRIDGE	173	LETHBRIDGE	236
MEDICINE HAT	6.7	MEDICINE HAT	177	MEDICINE HAT	56
GR. PRAIRIE	6.9	GR. PRAIRIE	73	GR. PRAIRIE	19
TOTAL	158.6	TOTAL	1378	TOTAL	816

METHOD OF PAYMENT

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	28171	61381	18031	47679	4331	5179	17316	181638
BARLEY	4014	38845	57187	48949	61834	32967	34909	278705
CANOLA	528	6965	5164	22692	11748	4950	17319	69366
OATS					17908			

HOGS (000 Head)	MEAN	Cows(000 Head)	MEAN	FEEDERS (000 Head)	MEAN
RED DEER	44.3	RED DEER	251	RED DEER	192
VERMILION	26.0	VERMILION	324	VERMILION	167
CALGARY	16.3	CALGARY	246	CALGARY	174
EDMONTON	25.5	EDMONTON	225	EDMONTON	79
LETHBRIDGE	34.7	LETHBRIDGE	182	LETHBRIDGE	312
MEDICINE HAT	7.1	MEDICINE HAT	194	MEDICINE HAT	56
GR. PRAIRIE	7.0	GR. PRAIRIE	79	GR. PRAIRIE	22
TOTAL	160.9	TOTAL	1502	TOTAL	1001

-5% Decline in GTRAN and off-Board barley price.

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	24600	56392	15639	48576	4553	5179	16497	171434
BARLEY	3649	36837	49949	47060	59603	31711	34045	262855
CANOLA	528	6809	5043	22258	11748	4950	16988	68324
OATS					17908			

HOGS (000 Head)	MEAN	COWS (000 Head)	MEAN	FEEDERS (000 Head)	MEAN
RED DEER	44.3	RED DEER	248	RED DEER	181
VERMILION	26.0	VERMILION	323	VERMILION	156
CALGARY	16.3	CALGARY	244	CALGARY	157
EDMONTON	25.5	EDMONTON	225	EDMONTON	79
LETHBRIDGE	34.7	LETHBRIDGE	175	LETHBRIDGE	289
MEDICINE HAT	7.1	MEDICINE HAT	162	MEDICINE HAT	48
GR. PRAIRIE	7.0	GR. PRAIRIE	77	GR. PRAIRIE	20
TOTAL	160.9	TOTAL	1453	TOTAL	930

+5% Change on GTRAN and off-Board barley price

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	31278	66370	20948	45828	4133	5179	18042	191777
BARLEY	4292	40853	61395	52221	63934	34562	35773	293031
CANOLA	528	7126	5289	23126	11748	4950	17650	70240
OATS					17908			

HOGS (000 Head)	MEAN	Cows(000 Head)	MEAN	FEEDERS (000 Head)	MEAN
RED DEER	44.3	RED DEER	254	RED DEER	202
VERMILION	26.0	VERMILION	325	VERMILION	177
CALGARY	16.3	CALGARY	249	CALGARY	191
EDMONTON	25.5	EDMONTON	225	EDMONTON	79
LETHBRIDGE	34.7	LETHBRIDGE	190	LETHBRIDGE	336
MEDICINE HAT	7.1	MEDICINE HAT	231	MEDICINE HAT	66
GR. PRAIRIE	7.0	GR. PRAIRIE	80	GR. PRAIRIE	24
TOTAL	160.9	TOTAL	1555	TOTAL	1075

In general, a 5% decline in the GTRAN coefficient reduces the provincial average wheat, barley and canola production by 5.6%, 5.7%, and 1.5% respectively from the method of payment (MOP) results.

In Region 1, a predominant wheat growing area, wheat production decreased 12.7% from the MOP results. Region 3 wheat and barley had a similar change. In Region 4, an area in which all three crops tend to compete for available acreage, barley and canola production declined by 3.9% and 1.9% respectively. Wheat production increased 1.9%, the result of lagged barley acreage being inversely related to current wheat production. All other regions tended to change similarly to Region 4, i.e., a 5% change resulted in a less than 5% change in production.

Provincially, a 5% increase in the GTRAN coefficient resulted in a 5.6%, 5.1% and 1.3% increase in wheat, barley and canola production respectively. Region 1 wheat production increased 11% on average. In Region 4, barley and canola production increased 6.7% and 1.9% respectively, while wheat production declined 3.9% from the MOP results. As above, Regions 2, 5, 6 and 7 were similar to Region 4, while Region 3 was similar to Region 1.

Provincially, a 5% decline in the off-Board barley price coefficient (or other shift variables), resulted in a 3.3% (49,000 Head) decline in the cow herd, and a 7% (71,000 Head) decrease in feeder steers and heifers from the MOP results. Hog numbers remained unchanged, as a change in the coefficient on the hog price to barley price ratio variable was performed under scenario 2. The largest cow herd decline (16% or 32,000 Head) was

found in region 1 (Medicine Hat), while all other regions experienced a decline less than 3.8%.

Feeder inventories in Regions 2 and 5, the main feedlot areas, declined by 7.4% (23,000 Head), and 5.7% (11,000 Head) respectively from the MOP results. Regions 1 and 7, least in feeder numbers, decreased by 14% (8,000 Head), and 9% (2,000 Head) respectively.

A 5% increase resulted in an increase provincially in the cow herd and feeder inventory by 3.5% (53,000 Head) and 7.4% (74,000 Head) respectively. The largest increase in the cow herd was in Region 1 at 19% (37,000 Head). Feeder inventories in Regions 2 and 5 increased by 7.7% (24,000 Head) and 5.2% (10,000 Head) respectively. Regions 1 and 7 increased 17.9% (10,000 Head) and 9% (2,000 Head) respectively.

Summary

The producer method of payment results are generally not sensitive to a change in the GTRAN coefficient nor the off-Board barley price (or other shifter) coefficient. Region 1 appears most sensitive to a 5% change in the coefficients which, given the lack of alternatives to grain farmers and ranchers in the region, seems reasonable.

Scenario 2

The following table describes the average grain and livestock results under a 5% increase and a 5% decrease in the coefficient on the board and canola price in the grain supply equations and on the calf and hog price in the livestock equations. Refer to table 1 for baseline and method of payment results.

Table 2: Grain Production and Livestock Inventory Changes under Sensitivity Scenario 2.

-5% Change in Board/canola price and calf/hog price

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	25561	59698	17798	45732	4484	4803	16001	174077
BARLEY	3789	38335	56343	48627	59842	32462	34510	273909
CANOLA	488	6544	4709	21862	11748	4950	16629	66930
OATS					17908			

HOGS (000 Head)	MEAN	COWS (000 Head)	MEAN	FEEDERS (000 Head)	MEAN
RED DEER	44.1	RED DEER	251	RED DEER	184
VERMILION	25.9	VERMILION	322	VERMILION	165
CALGARY	16.2	CALGARY	242	CALGARY	168
EDMONTON	25.3	EDMONTON	224	EDMONTON	79
LETHBRIDGE	34.6	LETHBRIDGE	180	LETHBRIDGE	292
MEDICINE HAT	7.1	MEDICINE HAT	193	MEDICINE HAT	55
GR. PRAIRIE	6.9	GR. PRAIRIE	77	GR. PRAIRIE	21
TOTAL	160.1	TOTAL	1488	TOTAL	965

+5% Change on Board/non-Board price and calf/hog price

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	30739	63064	18265	49063	4201	5554	18378	189804
BARLEY	4206	39355	58030	49302	63700	33501	35309	283404
CANOLA	568	7412	5644	23523	11748	4950	18009	71855
OATS					17908			

HOGS (000 Head)	MEAN	COWS (000 Head)	MEAN	FEEDERS (000 Head)	MEAN
RED DEER	44.5	RED DEER	251	RED DEER	199
VERMILION	26.1	VERMILION	325	VERMILION	167
CALGARY	16.4	CALGARY	251	CALGARY	179
EDMONTON	25.6	EDMONTON	226	EDMONTON	79
LETHBRIDGE	34.9	LETHBRIDGE	184	LETHBRIDGE	331
MEDICINE HAT	7.2	MEDICINE HAT	196	MEDICINE HAT	57
GR. PRAIRIE	7.0	GR. PRAIRIE	80	GR. PRAIRIE	23
TOTAL	161.6	TOTAL	1513	TOTAL	1036

Provincially, wheat, barley and canola production decline by 4%, 1.7% and 3.5% respectively from the MOP results with a 5% decline in the board and canola coefficients.

Region 1 wheat, while not being sensitive to barley acreage coefficient, decreases 9%, primarily in response to a 5.6% decline in lagged barley production. Region 4 wheat production declines 4%, while barley and canola production decreases by 0.7% and 3.7% respectively. Regions 2 and 3 wheat and barley appear least sensitive with declines in both crops by less than 2.7%.

Provincially, a 5% increase in the coefficients resulted in wheat, barley and canola increasing by 4%, 1.7% and 3.5% respectively. Region 1 wheat increased by 9% from the MOP results. Regions 2 and 3 appear least sensitive, not changing by more than 2.7%.

A 5% change (increase or decrease) in the calf price coefficient resulted in a less than 1% change in the cow herd and a 3.5% change in feeder steer and heifer inventories. Regionally, the change in feeders ranged from no change in Region 6 to 6% in Region 2.

A 5% change in the coefficient on the hog to barley ratio found a less than 0.5% change in hog breeding stock numbers.

Summary

The results from a producer method of payment appear to be insensitive to a change in the coefficient on price, as well as the coefficient on lagged barley acres in the wheat equation in Region 1.

One of the concerns of the group involved in the impact analysis was the sensitivity of production to a decline in yield following a change in method of payment. The rationale for a yield decline was that a decrease in grain prices would induce the farmer to reduce expenditures on fertilizer and pesticides. Agriculture Canada (1984) forecasted expenditures on fertilizer and pesticides following a change to a producer method of payment would decline by 1.3% and 0.9% respectively. Even though such a minor change in expenditures would likely not significantly affect yield, a sensitivity on yield was undertaken to provide what would possibly be an upper limit of change in yield.

Scenario 3

The following table depicts the average grain production results from a 5% decline in yield, given that acreage remains at the levels estimated under the MOP option.

Table 3: Grain Production under Baseline, Method of Payment and a 5% Yield Decline

BASELINE

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	27838	59171	16931	53452	7531	6887	18670	190480
BARLEY	3743	39366	44987	49415	64217	34774	35776	272278
CANOLA	405	5771	4092	18514	11748	4926	13694	59151
OATS					17012			

METHOD OF PAYMENT

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	28171	61381	18031	47679	4331	5179	17316	181638
BARLEY	4014	38845	57187	48949	61834	32967	34909	278705
CANOLA	528	6965	5164	22692	11748	4950	17319	69366
OATS					17908			

5% decline in yield

MEAN (000 Bushels)

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	26762	58312	17130	45295	4115	4920	16451	172985
BARLEY	3813	36903	54327	46502	58742	31318	33164	264769
CANOLA	502	6617	4906	21557	11161	4703	16453	65899
OATS					17012			

Percent change from baseline to scenario.

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	TOTAL
WHEAT	-3.9(1.2)	-1.5(3.7)	1.2(6.5)	-15(-11)	-45(-42)	-28(-24)	-12(-7)	-9(-4.6)
BARLEY	1.9(7)	-6(-1.3)	21(27)	-6(-1)	-9(-4)	-10(-5)	-7(-2)	-3(2.4)
CANOLA	24(30)	15(21)	20(26)	16(22)	-5(0)	-4.5(0)	20(26)	11(17.3)
OATS					0.0(5)			

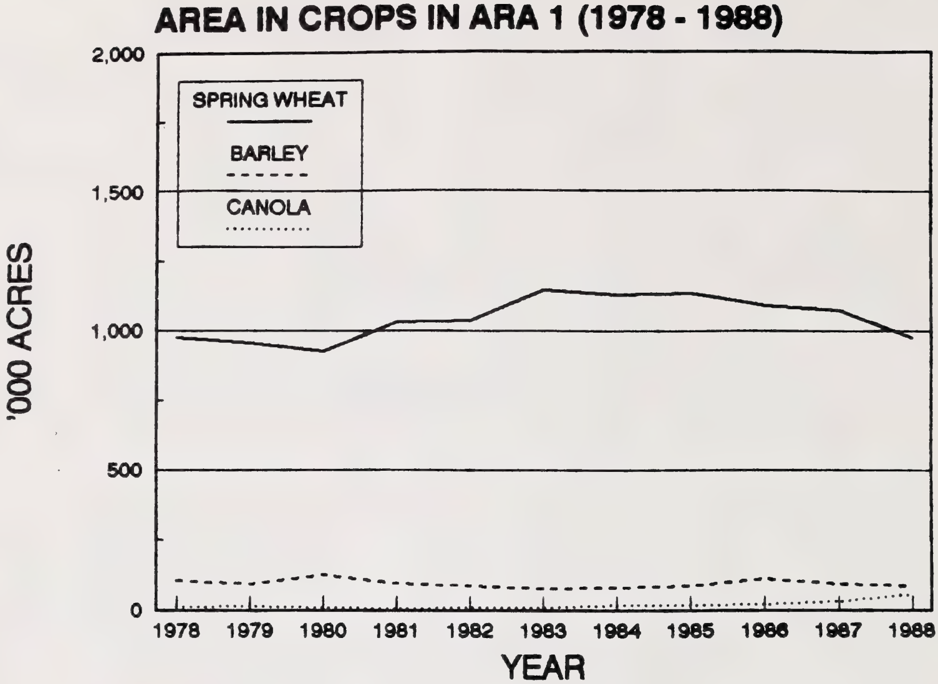
NOTE: Numbers in brackets represent percent changes from baseline to MOP.

Production is simply yield times acreage, and since yield is not estimated within the model, a 5% decline in yield reduces production by 5% as compared to the MOP results. As a result, with the exception of those changes from baseline to MOP between 0 and +5%, the directional effect of a 5% decline in yield would remain unchanged from the original analysis. The regions which exhibit a change in direction are Regions 1 and 2 wheat, showing a 3.9% and 1.5% decline respectively from the baseline scenario.

As mentioned earlier, previous research on yield response suggests minimal change following a change in method of payment. Any estimate of a change in yield in this study would merely be speculation.

APPENDIX E

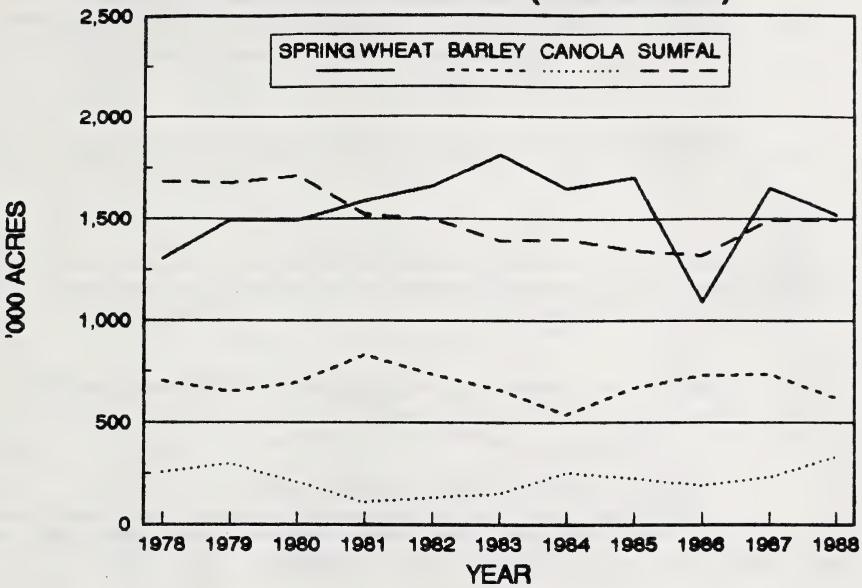
APPENDIX E



THOUSAND ACRES

	SPRING WHEAT	BARLEY	CANOLA	SUMFAL
1978	975	107	11.9	1,117
1979	955	93	14.1	1,124
1980	926	126	8.9	1,180
1981	1,032	97	5.4	1,238
1982	1,037	86	7.3	1,321
1983	1,148	78	9.6	1,223
1984	1,132	79	18.6	1,212
1985	1,136	88	17.4	1,178
1986	1,090	112	20.1	1,212
1987	1,074	95	32.5	1,255
1988	977	87	56.3	1,317

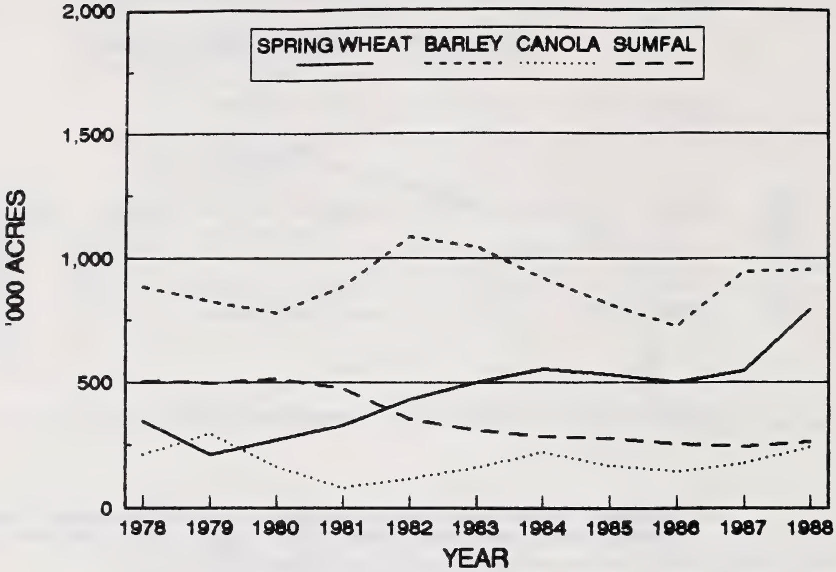
AREA IN CROPS - ARA 2 (1978 - 1988)



THOUSAND ACRES

	SPRING WHEAT	BARLEY	CANOLA	SUMFAL
1978	1,305	708	260.4	1,680
1979	1,494	652	298.7	1,679
1980	1,494	700	211.5	1,712
1981	1,586	833	112.7	1,522
1982	1,661	738	135.2	1,501
1983	1,812	663	154.6	1,391
1984	1,651	542	254.6	1,401
1985	1,703	669	226.6	1,347
1986	1,090	734	195.4	1,319
1987	1,650	739	234.1	1,494
1988	1,523	622	336.2	1,494

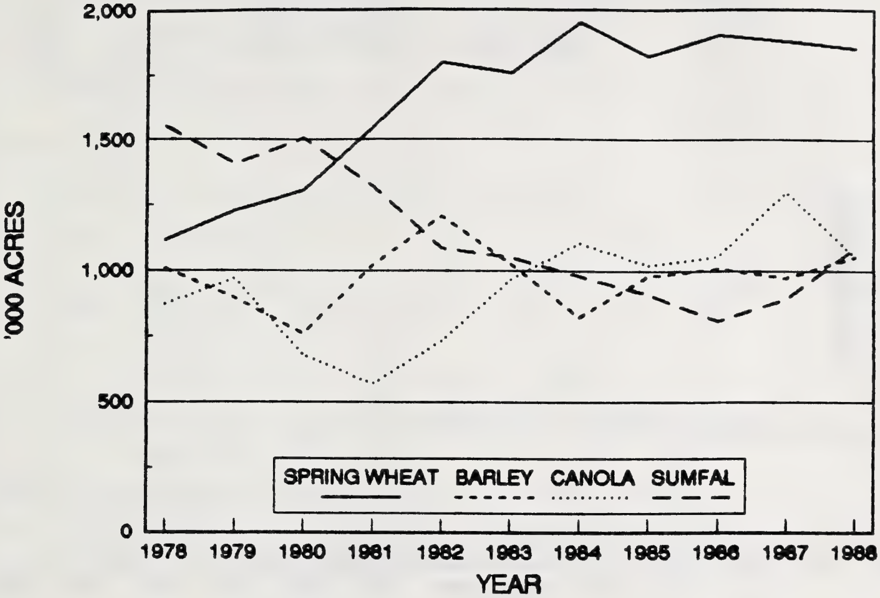
AREA IN CROPS - ARA 3 (1978 - 1988)



THOUSAND ACRES

	SPRING WHEAT	BARLEY	CANOLA	SUMFAL
1978	350	886	212.3	506
1979	214	828	299.3	501
1980	274	778	165.1	514
1981	333	885	83.6	476
1982	435	1,085	117.6	359
1983	505	1,047	161.1	313
1984	555	917	223.4	288
1985	533	815	171.2	279
1986	503	728	147.4	257
1987	547	946	180.4	248
1988	792	955	243.0	265

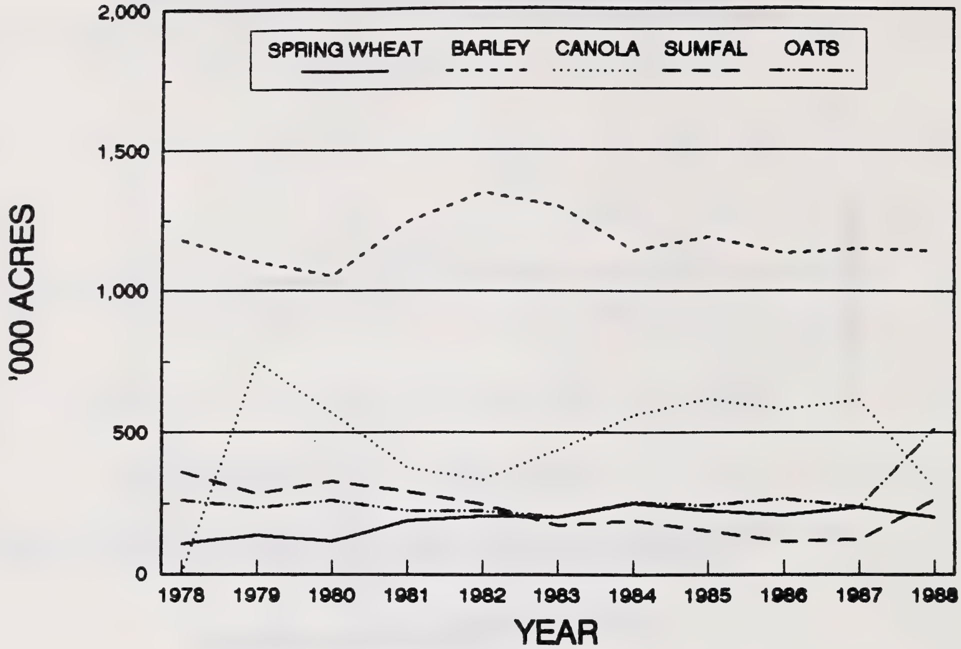
AREA IN CROPS - ARA 4 (1978 - 1988)



THOUSAND ACRES

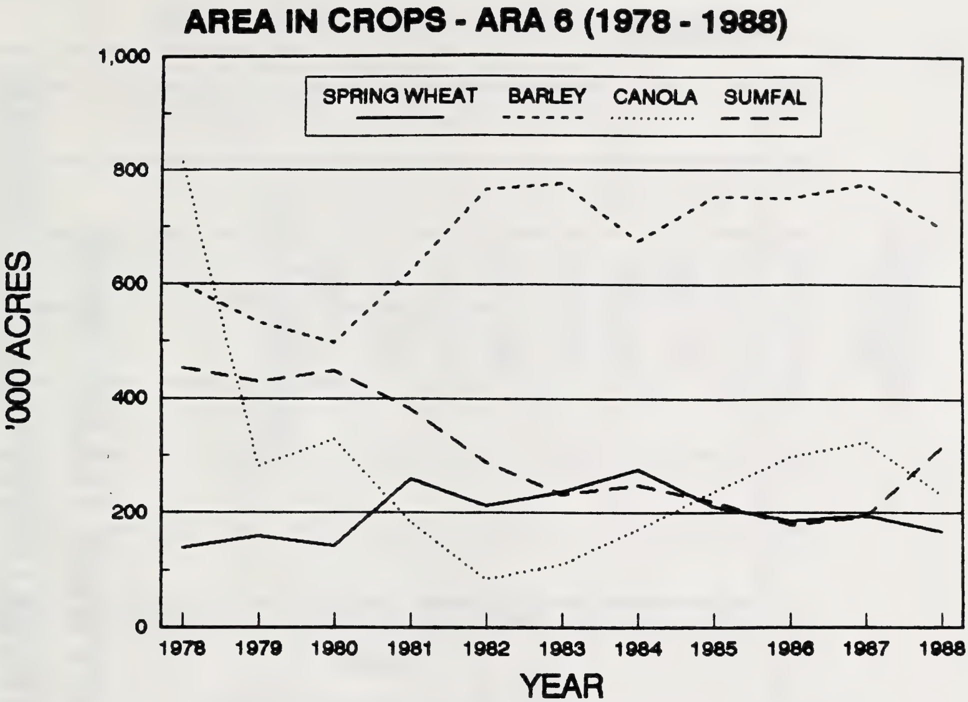
	SPRING WHEAT	BARLEY	CANOLA	SUMFAL
1978	1,118	1,011	874.4	1,558
1979	1,228	897	969.9	1,411
1980	1,308	763	682.7	1,510
1981	1,552	1,022	567.8	1,325
1982	1,798	1,207	732.7	1,087
1983	1,755	1,028	968.7	1,053
1984	1,953	825	1,107.7	983
1985	1,822	981	1,023.8	910
1986	1,903	1,008	1,055.4	811
1987	1,879	974	1,303.1	898
1988	1,855	1,054	1,053.7	1,090

AREA IN CROPS - ARA 5 (1978 - 1988)



THOUSAND ACRES

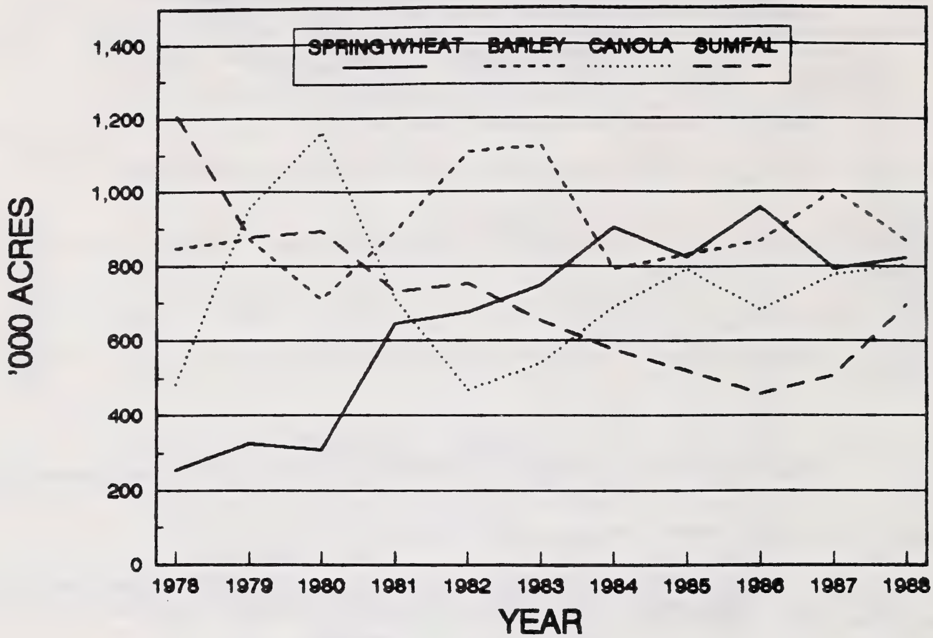
	SPRING WHEAT	BARLEY	CANOLA	SUMFAL	OATS
1978	106	1,182	0.0	362	260
1979	140	1,105	748.6	284	236
1980	116	1,056	572.6	330	262
1981	190	1,250	376.7	294	226
1982	208	1,353	335.6	250	227
1983	204	1,303	440.5	176	205
1984	251	1,147	562.2	190	257
1985	225	1,195	620.6	157	245
1986	210	1,137	582.3	118	268
1987	240	1,154	615.5	122	240
1988	204	1,145	312.1	266	513



THOUSAND ACRES

	SPRING WHEAT	BARLEY	CANOLA	SUMFAL
1978	140	599	815.2	453
1979	161	533	282.4	430
1980	143	498	328.1	449
1981	259	623	184.1	381
1982	213	766	84.9	289
1983	238	775	110.9	232
1984	276	677	171.1	248
1985	211	754	237.3	219
1986	186	752	298.0	179
1987	195	776	324.3	194
1988	169	702	231.9	316

AREA IN CROPS - ARA 7 (1978 - 1988)



THOUSAND ACRES

	SPRING WHEAT	BARLEY	CANOLA	SUMFAL
1978	255	847	485.4	1,207
1979	326	872	956.4	877
1980	310	710	1,161.7	894
1981	647	894	712.8	732
1982	678	1,109	468.8	755
1983	750	1,123	541.4	654
1984	905	793	689.8	577
1985	826	834	794.9	522
1986	959	868	683.0	460
1987	793	1,004	777.2	509
1988	823	869	805.3	699

PROVINCIAL WHEAT REVENUES GIVEN THE DIFFERENT
SENSITIVITY ANALYSIS ON THE GTRAN COEFFICIENTS
IN THOUSANDS OF DOLLARS (1978-1988)

	5% DECREASE	5% INCREASE
1978	245,248	279,623
1979	318,915	351,603
1980	484,972	530,615
1981	614,499	693,332
1982	793,858	886,008
1983	774,081	852,694
1984	577,399	651,666
1985	599,392	703,626
1986	773,456	842,969
1987	622,658	699,721
1988	430,424	485,889

APPENDIX F

APPENDIX F

SEP 2 2 1988
SECRETARIAT

Trade Policy Implications of a Pay the Producer Option in Alberta and British Columbia under the Western Grain Transportation Act

by W. M. Miner, Alberta Trade Consultant

Background

The provinces of Alberta and British Columbia have proposed a mechanism for paying the Crow Benefit under the Western Grain Transportation Act (WGTA) to producers rather than to the railways. A consideration in introducing this option is the possible impact of a policy change on the implementation of the Canada-US Free Trade Agreement (FTA) and the multilateral trade negotiations (MTN) underway in GATT.

Policy Impacts

The trade policy impacts will depend upon the manner in which the pay the producer method of payment is applied (PPMP), its effects on production, marketing and trade flows, particularly on exports to the United States, the manner in which the Canadian Wheat Board (CWB) handles sales to the US market and the reactions of Canada's trading partners to the policy change.

This paper is based on the administrative mechanism proposed by Alberta and British Columbia. It is understood that the proposal will apply to those grains, oilseeds and products currently covered by the WGTA. The producer

of grains will receive the payments for eligible sales to eligible purchasers for export or domestic use. Transactions within the CWB designated area and outside the program area will be ineligible for payments. Sales to eligible buyers outside the program area (and the CWB designated area) within Canada will be eligible through a certificate system. Sales to merchants for export offshore will also be eligible. In accordance with changes to be made in the WGTA under the FTA, sales to the United States will be ineligible for payments and if such traded grain has been bought at a lower price within the program area and sold into the higher priced non-program area the seller will have to remit an amount to compensate for the designated rate. These arrangements should prevent any of the direct payment benefits from being received for sales to the United States. A system will be developed for farm-fed and farm feeding to include these operations in the program.

The PPMP is designed to reflect full cost freight rates in prices within the program area. The extent to which prices will be lower will depend on the nature of the market for various commodities and products, particularly the influence of markets outside the program area. However, prices within the program area will be lower and are likely to have significant effects on production, processing and markets. It is assumed that these changes will be in the directions indicated in the Hall Commission report and recent studies undertaken by Alberta Agriculture. Livestock production and feeding will be encouraged. The higher value crops such as canola and pulses and oilseed processing will benefit. Little impact is likely on production of the higher quality cereals whereas other lower priced grains will be somewhat discouraged. These developments

may result in higher exports of grain, livestock and products to the United States, encouraged by the lower price structures in the program area although these shipments will not be eligible for payments. The gains experienced in beef fattening will probably draw feeder cattle to the fattening areas of Alberta from Saskatchewan and possibly neighboring US states. Exports of red meats should increase.

CWB Sales to the United States

The manner in which the CWB administers exports of wheat, oats, barley and grains sold for products to be exported to the United States under the FTA is a factor in assessing the trade policy implications of the PPMP. The CWB operations are unlikely to change from the current procedure in which the Board establishes a price for export sales reflecting their judgement of the going international price. The Board would be unable to administer sales at levels below the equivalent of the initial payment. It is likely that exports to the United States will continue to be made through CWB agents or handled directly by individual shippers with export permission granted by the Board. In general, the CWB is likely to price sales for use within Canada on an import basis to remain competitive with US grains that may move in following the lifting of CWB import controls. As payments under the PPMP would not be available for shipments to the United States, producers or shippers in the program area would endeavor to price such sales at levels equivalent to those prevailing in the remainder of the designated area.

Multilateral Trade Negotiations

Two aspects of subsidies provided under the WGTA are likely to be raised in the MTN; the question of direct export subsidies as the current payments are based on export quantities and the trade effects of cost-reducing subsidies targetted on grains and grain products. A shift in the method of subsidy payment from a transportation subsidy to a direct producer payment is consistent with the policy directions being advocated by the industrial countries. Payments in the program area could no longer be regarded as direct export subsidies as they would be paid on most sales for domestic use or export (except to the United States). However, payments under the proposed PPMP would continue to be grains specific, be shown in government expenditures as payments under the WGTA and included in the measurement of subsidies which may distort trade. Although it would not be regarded as decoupled, it could be argued that the payments are partially decoupled. There would be a limited chance that the payments would be given less weight in the calculation of producer subsidy equivalents (PSE's). In summary, in the MTN context, subsidies under the PPMP would probably be viewed as transfers to benefit the production and marketing of grains, oilseeds and products and would be subject to negotiations in much the same manner as WGSA payments. It could not be regarded as a direct export subsidy, and may be viewed as partially decoupled.

Free Trade Agreement

There are some implications of the PPMP for implementation of the FTA and the application of existing US countervail legislation. These arise from:

(i) the measurement of levels of producer support in relation to reaching a decision on the removal of CWB import licensing for US grains;

(ii) the provision that would allow either party to introduce or reintroduce border controls in cases where imports increase substantially as a result of policy changes;

(iii) the implications for the application of US countervail law.

With respect to determining the equivalent levels of producer subsidies as measured by PSE's, the payments under PPMP are likely to be included in the calculations as payments under the WGTA. In this respect, there would be no change from the existing policies. It could be argued that the change in the method of payment makes the subsidies less trade distorting but the United States is unlikely to accept such an argument.

In the event of increased exports of grains, oilseeds and products from Alberta and British Columbia, the United States would not be an eligible destination for payments under the PPMP, therefore the issue of the effects on the movement of the policy change should not arise. However, US groups could argue that the increased movements are indirectly due to the PPMP policy change introduced subsequent to the FTA negotiations and request the imposition of Section 22 quotas. In these circumstances it should be possible to argue that the payments were included in the overall measurement of support as previously agreed and have been taken into account in determining relative levels of producer support. In addition, the payments are being made in a manner which is less trade-distorting. If the shipments from Alberta and Bristish Columbia increased more rapidly than from other sources, the US case would be strengthened. On balance, it is considered unlikely that the policy change could be used to justify the reintroduction by the United States of import restrictions.

However, US groups could bring a case for countervail action based on the allegation that the payments under PPMP are responsible for increased shipments from the program area. Such a case would have to be judged on its merits. The subsidies provided in the program area would be at the same level as those provided across the CWB designated area consequently the facts of the case would not be different than prior to the policy change. The change may increase the risk of triggering countervail action but would not strengthen the US case.

In conclusion, the policy change under the PPMP
is unlikely to have trade policy implications in the
MTN and may be marginally helpful to the Canadian position.
It should not affect the implementation of the FTA but
may increase the risk of countervail action if exports
to the United States from Alberta and British Columbia
increase significantly. However, it would not strengthen
the US case for a positive finding of countervailable
subsidies.

References

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